ROHDE&SCHWARZ
Test and Measurement
Division

Software Manual

GSM/DCS/PCS Mobile Tests

Application Firmware Module FSE-K10

1057.3092.02

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Republic of Germany

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Supplement to FSE-K10 and FSE-K11 Manuals

K10/K11 Limit Lines

For FSE options K10 and K11 (GSM mobile station and GSM base station analyzer), many internal limit lines are used which are derived from the applicable standards. To make these limit lines accessible to the user, they are available as data sets on this CD under Options\ Lim-Line. There are 6 data sets:

K10_XGSM.LIA	Limit lines for mobiles, standards EGSM, PGSM and RGSM
K10_DCS.LIA	Limit lines for mobiles, standards DCS1800 (GSM 1800)
K10_PCS.LIA	Limit lines for mobiles, standards PCS1900 (GSM 1900)
K11_XGSM.LIA	Limit lines for base stations, standards EGSM, PGSM und RGSM
K11_DCS.LIA	Limit lines for base stations, standards DCS1800 (GSM 1800)
K11_PCS.LIA	Limit lines for base stations, standards PCS1900 (GSM 1900)

To load the data sets, proceed as follows:

1. Copy the desired data sets (one or several) from the CD to disk or analyzer.
2. Press the hardkey RECALL, and enter path (for example A:\) via softkey EDIT PATH (see operating manual, section 2.7.3).
3. Select menu item "Lines" via softkey ITEMS TO RECALL (this is the default setting; see operating manual, section 2.7.3.1).
4. Select the desired data set via softkey DATA SET LIST. This will cause all limit lines of the selected data sets to be copied to the limit line directory of the instrument.

From the GSM software, the limit lines can be accessed and edited via the softkey EDIT in the righthand side menus of the following measurements:

- Power vs time
- Modulation spectrum
- Transient spectrum or
- Spurious

Outside GSM measurements, the limit lines are accessible in the analyzer mode of the instrument.

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1 Getting Started

This chapter is mainly intended for users operating the GSM MS analyzer mode for the first time. Users are guided step by step through the most frequent tests that are performed on mobiles.

User guidance starts with connecting FSE/FSIQ and making the required presettings before the individual measurements are explained.

The layout and contents of this chapter are application-oriented and provide important information on FSE/FSIQ as well as the GSM900/DCS1800/PCS1900 system.

It is recommended to read through this chapter and at the same time perform the operations on FSE/FSIQ. This ensures a simple and rapid introduction to the GSM MS firmware functions so that correct and useful measurement results are achieved.

Each individual step is provided with a reference number, eg ①, relating to a more detailed information on the opposite page.

General information on FSE-K10 is provided in chapter 2. Chapter 3 gives detailed information on menus and softkeys and contains a graphical menu overview. Remote-control commands and their assignment to softkeys is described in chapter 4.

Note: *The descriptions of some of the functions are provided with a note to the effect that these functions are available only with Vector Signal Analysis Option FSE-B7 installed. This note applies only to FSE, while FSIQ contains these functions already in the basic version.*

1.1 Connecting the FSE/FSIQ

1.1.1 Standard Test Setup

In general, a system simulator (eg CRTP or also CMD from R&S) is required to test the mobile. This system simulator makes the necessary measurement-specific settings and provides the necessary frequency accuracy of the mobile.

The mobile has to be equipped with a test SIM.

If the mobile has a special service mode, most of the measurements can be performed without a system simulator (exception: frequency errors. To attain the required frequency accuracy, the mobile needs a corresponding synchronization burst).

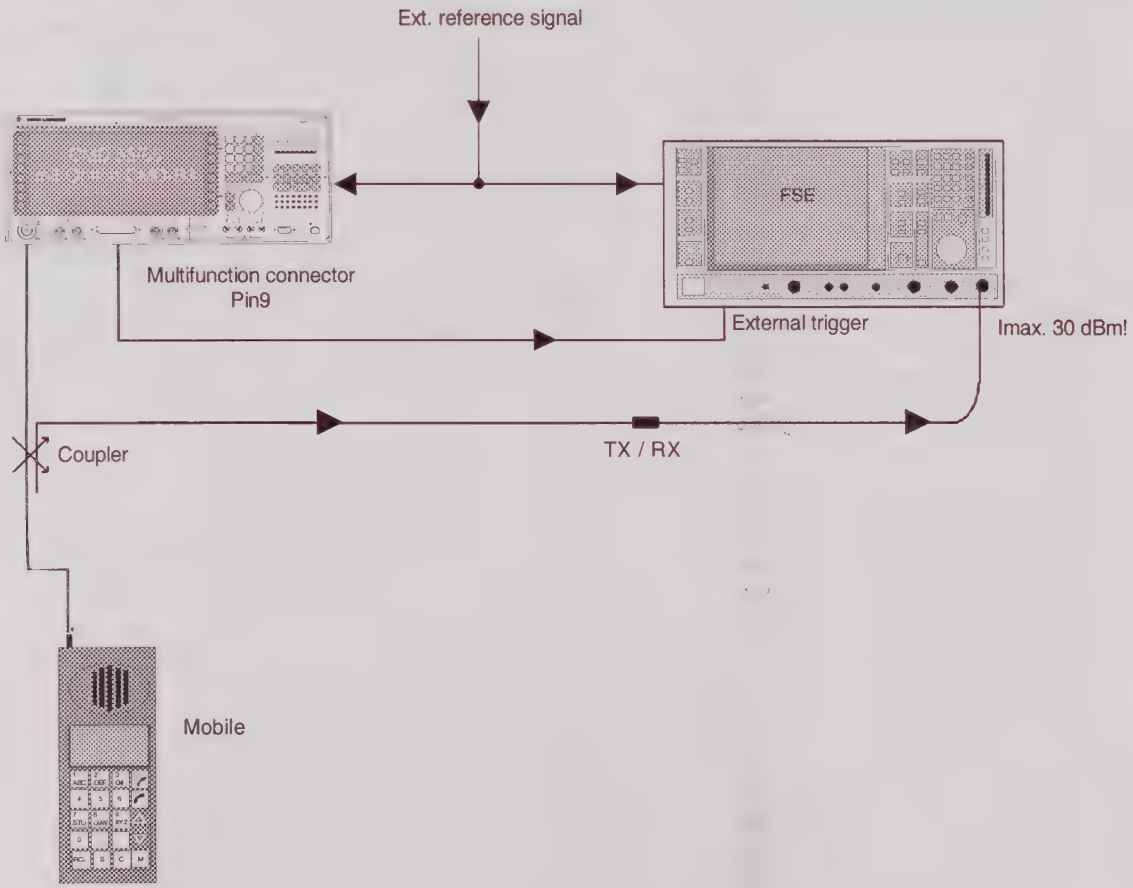


Fig. 1-1 Measurement setup with CMD 55/65 as system simulator for all measurements except modulation spectrum RX band

The CMD must be fitted with Option CMD-B3 (external reference frequency input).

- Connect frame trigger output of CMD65 with rear BNC connector *EXT TRIG GATE* (external trigger or gate input) of FSE/FSIQ.
  With the aid of this external trigger signal FSE/FSIQ is able to exactly trigger even in case of measurements outside the carrier (eg spectrum due to modulation).
- Connect antenna output (or TX output) of MS to FSE/FSIQ RF input via a coupler of suitable attenuation (eg 20 dB).
  For measurements of the spectrum due to modulation in the **RX band**, the attenuation between the mobile's antenna output and the FSE/FSIQ input must not exceed 6 dB. The TX signal must be suppressed by at least 25 dB by means of a bandstop filter.

1.2 Presetting the FSE/FSIQ

Step 1

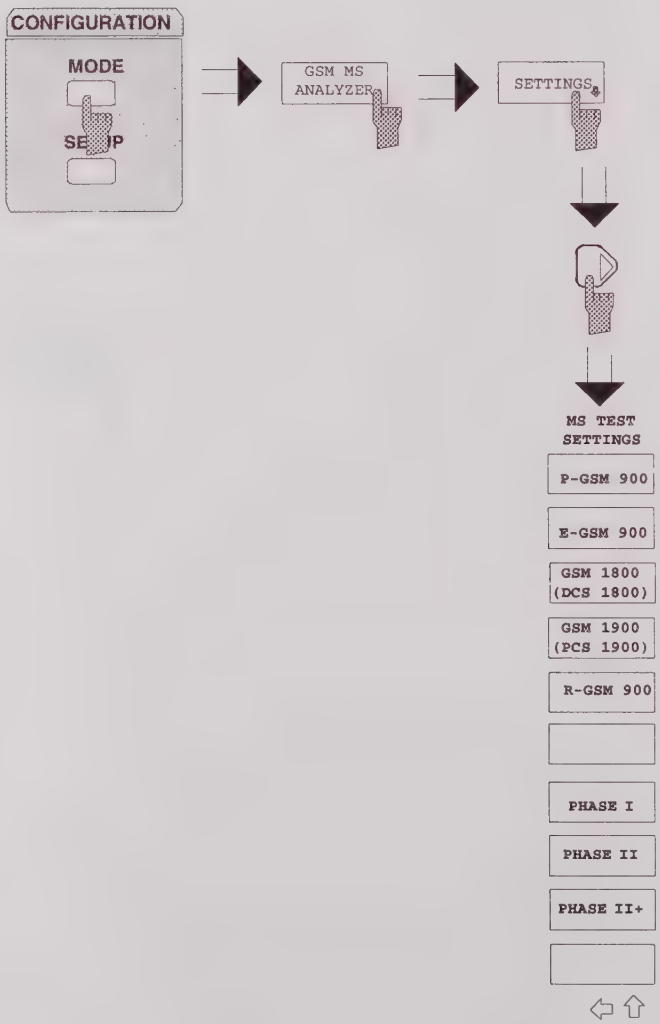
Setting the reference frequency

- Press SETUP key.
- Press *EXT. REF FREQUENCY* ① key and enter the frequency according to the frequency standard.
- Switch *REF INT/EXT* softkey to *EXT* (external reference frequency).

Step 2

Selecting the standard

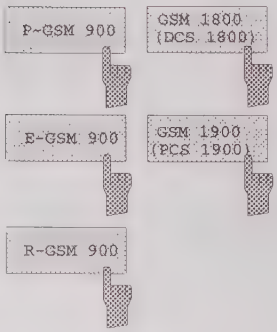
- Successively press the *MODE* key, the *GSM MS ANALYZER* softkey, the *SETTINGS* softkey and the ▷ key. The following menu for selecting the different standards is displayed.



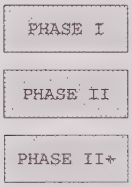
Additional information

Step 1

① To attain the required frequency accuracy during frequency error measurement *(PHASE/FREQ ERROR)*, FSE/FSIQ has to be supplied with a highly accurate (error< $1*10^{-9}$) external reference frequency n x 1 MHz , where n = 1,2, ... 16.



For GSM900 and DCS1800:



Step 3

Select the correct standard P-GSM900, E-GSM900, DCS 1800, PCS 1900, or R-GSM depending on the MS to be tested.

The *PHASE I/II/II+* softkeys changes the sequence of measurements and the associated limit values according to the selected phase of the standard.

➢ Choose between phase I, II or II+. With some standards, the softkeys are not available (PCS 1900) or partly available because no phases or not all of them are defined.

Returns to main menu Setting after pressing the key ⏎ .

Step 4

Entering external attenuation

➢ Press the *EXTERNAL ATTEN* softkey.

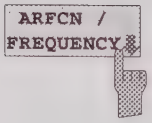
➢ Enter the attenuation of the external attenuator used. (Recommended attenuation see ②)

Additional information

Step 4

② The following values are recommended for the external attenuator to ensure that the FSE/FSIQ RF input is protected and the sensitivity of the FSE/FSIQ is not reduced too much.
The FSE/FSIQ level display is automatically corrected by the entered value.

Max. power	Recommended ext. attenuation
≥ 40 - 45 dBm	20 dB - 25 dB
≥ 35 - 40 dBm	15 dB - 20 dB
≥ 30 - 35 dBm	10 dB - 15 dB
≥ 25 - 30 dBm	5 dB - 10 dB
≥ 20 - 25 dBm	0 dB - 5 dB
< 20 dBm	0 dB



Step 5

Selecting the transmission channel

➢ Press the *ARFCN / FREQUENCY* softkey.

➢ Press the *ARFCN*, A*RFCN AUTOSELECT* or *FREQUENCY* softkey.

With *ARFCN* selected:

➢ Enter the transmit channel number of your mobile. ③
FSE/FSIQ will tune to the associated frequency in compliance with the selected standard.

With *ARFCN AUTOSELECT* selected, FSE/FSIQ automatically searches for the active transmit channel on condition that frequency hopping is not active.

With *FREQUENCY* selected:

➢ Enter the transmission frequency of your MS or any other frequency (eg the IF of the mobile).
Permissible frequencies are:
1.8 MHz ≤ frequency ≤ (maximum device frequency– 1.8 MHz).

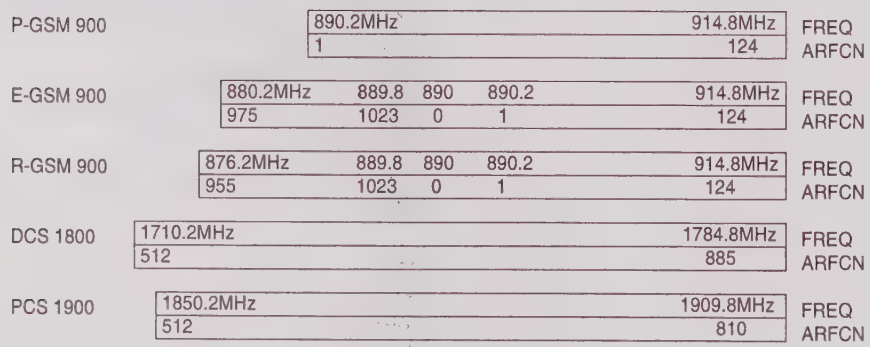
➢ Press ⌂ to return to the Settings menu.

Additional information

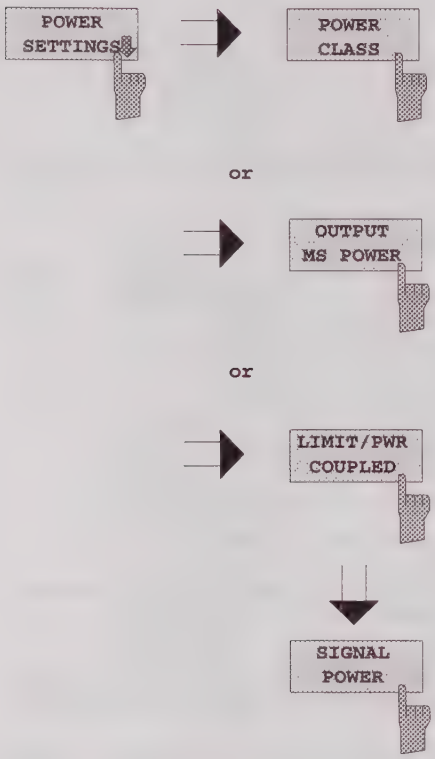
Step 5

③ Enter one of the possible channel numbers 1 to 124 for the P-GSM frequency range. For the extended GSM band, enter a number between 975 and 1023 or 0. Numbers available for PCN (DCS1800) are 512 to 885, and for PCS1900 512 to 810. In addition to the numbers of the P-GSM band (1 to 124), channel numbers 955 to 1023 or 0 are available for R-GSM.

Range	Channel number	Frequency downlink (BS-->MS)	Duplex offset
P-GSM	1 to 124	f = 890 MHz + (n * 0.2 MHz)	+45 MHz
E-GSM	0 to 124	f = 890 MHz + (n * 0,.2 MHz)	+45 MHz
	975 to 1023	f = 890 MHz + ((n - 1024) * 0.2 MHz)	+45 MHz
DCS1800	512 to 885	f = 1710.2 MHz + ((n - 512) * 0.2 MHz)	+95 MHz
PCS1900	512 to 810	f = 1850.2 MHz + ((n - 512) * 0.2 MHz)	+80 MHz
R-GSM	0 to 124	f = 890 MHz + (n * 0.2 MHz)	+45 MHz
	955 to 1023	f = 890 MHz + ((n - 1024) * 0.2 MHz)	+45 MHz



Frequencies in MHz



Step 6

Setting FSE/FSIQ to output power of MS

- First press the *POWER SETTINGS* softkey, then *POWER CLASS* and enter the power class of MS. ④
- As an alternative enter the nominal power of the MS by pressing the *OUTPUT MS POWER* softkey.

In addition, it is possible to enter the power linked neither to a power class nor to a power control level.

- For this select *LIMIT/PWR COUPLED OFF* and enter the power using softkey *SIGNAL POWER*.

Additional information

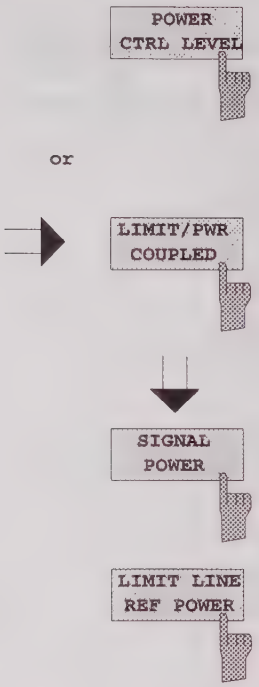
Step 6

④ The following table contains the power classes for the different standards and their associated peak powers:

	Power				
Power class	**GSM 900 phase I**	**R/E/P-GSM900 phases II & II+**	**DCS1800 phase I**	**DCS1800 phases II & II+**	**PCS1900**
1	43 dBm (20W)	--	30 dBm (1W)	30 dBm	30 dBm
2	39 dBm (8W)	39 dBm (8W)	24 dBm (0.25W)	24 dBm	24 dBm
3	37 dBm (5W)	37 dBm (5W)	--	36 dBm	33 dBm
4	33 dBm (2W)	33 dBm (2W)	--	--	--
5	29 dBm (0.8W)	29 dBm (0.8W)	--	--	--

To protect the FSE/FSIQ, the settings made in the POWER menu are automatically checked to make sure that the input level at the FSE/FSIQ does not exceed 27 dBm.

To prevent the occurrence of an overload, a warning is displayed for those settings which would lead to the threshold level being exceeded (*POWER CLASS, EXTERNAL ATTEN, OUTPUT MS POWER)* and the set value is ignored.



SIGNAL POWER and *LIMIT REF POWER* are available only if *LIMIT/PWR COUPLED* is inactive.

Step 7

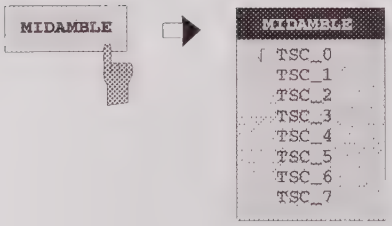
With reduced level of the MS, enter the power control level in addition.

➢ Enter the desired power control level N. ⑤.

The coupling between power and that of the power class as well as between the power actually applied and the limits selected with respect to this power can be suppressed (softkey *LIMIT/PWR COUPLED*).

➢ In this case enter the actual output power of MS (external attenuation is taken into account) by pressing the *SIGNAL POWER* softkey.

With the *LIMIT LINE REF POWER* softkey, the power determining the selection of limits can be chosen (only for measurements with limit values that vary with the MS power).



Step 8

Selecting the current midamble

➢ Press the *MIDAMBLE* softkey. A table indicating the training sequences (midamble) is displayed on the screen.

➢ Selection is performed by means of the ⏶ and ⏷ keys and the ENTER key.

Additional information

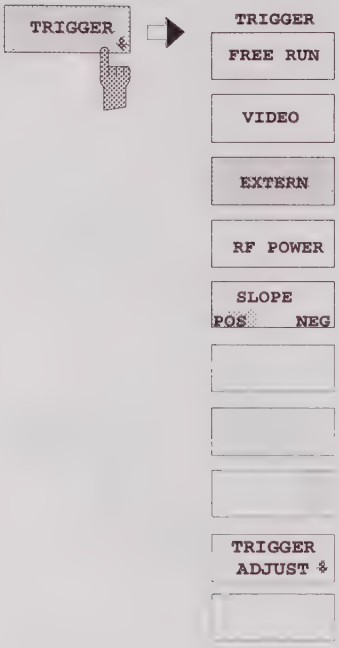
Step 7

⑤ The following power control level values may be set for the different standards, provided power of power class ≥ power of power control level.

Power control level	Power				
	GSM900 phase I	GSM900 phases II & II+ R-GSM	DCS1800 phase I	DCS1800 phases II & II+	PCS1900
29	--	--	--	36 dBm	reserved
30	--	--	--	34 dBm	33 dBm
31	--	--	--	32 dBm	32 dBm
0	43 dBm	39 dBm	30 dBm	30 dBm	30 dBm
1	41 dBm	39 dBm	28 dBm	28 dBm	28 dBm
2	39 dBm	39 dBm	26 dBm	26 dBm	26 dBm
3	37 dBm	37 dBm	24 dBm	24 dBm	24 dBm
4	35 dBm	35 dBm	22 dBm	22 dBm	22 dBm
5	33 dBm	33 dBm	20 dBm	20 dBm	20 dBm
6	31 dBm	31 dBm	18 dBm	18 dBm	18 dBm
7	29 dBm	29 dBm	16 dBm	16 dBm	16 dBm
8	27 dBm	27 dBm	14 dBm	14 dBm	14 dBm
9	25 dBm	25 dBm	12 dBm	12 dBm	12 dBm
10	23 dBm	23 dBm	10 dBm	10 dBm	10 dBm
11	21 dBm	21 dBm	8 dBm	8 dBm	8 dBm
12	19 dBm	19 dBm	6 dBm	6 dBm	6 dBm
13	17 dBm	17 dBm	4 dBm	4 dBm	4 dBm
14	15 dBm	15 dBm	--	2 dBm	2 dBm
15	13 dBm	13 dBm	--	0 dBm	0 dBm
16	--	11 dBm	--	--	reserved
17	--	9 dBm	--	--	reserved
18	--	7 dBm	--	--	reserved
19	--	5 dBm	--	--	reserved
20..31	--	5 dBm	--	--	reserved

The maximum selectable power control level depends on the power class of the mobile.
Example:
P_GSM900
Power class = 2 (≡ 39 dBm)
PWR CTRL Level = 2 ... 15

If an unpermissible Power Control Level is entered, FSE/FSIQ signals:
CHECK POWER CLASS



Step 9

Setting the trigger

➢ Press the *TRIGGER* softkey.
The default setting for the trigger is EXTERN. This default setting is applicable to all measurements. A corresponding trigger signal is required (frame trigger).
The default setting for the external trigger level ⑥ is 1.4 V but, if required, the level can be adapted by pressing *EXTERN* and then entering a new value in the data entry field. The polarity of the trigger signal can be set using the *SLOPE POS NEG* softkey.

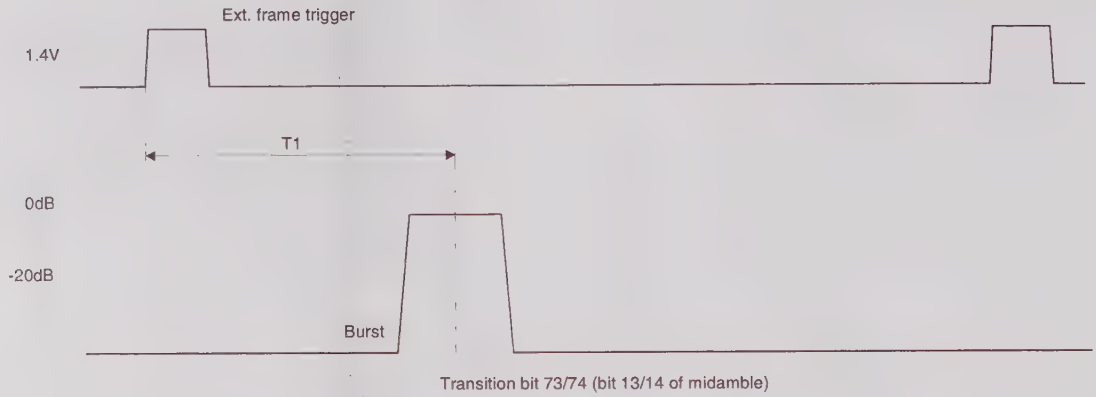
The default setting is the positive slope.

➢ Press the *TRIGGER ADJUST* softkey to set the trigger reference. Automatic (preferably) or manual adjustment can be performed.

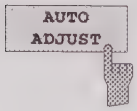
Additional information

Step 9

⑥



T1 = Reference time for delay to be adjusted with *AUTO ADJUST*

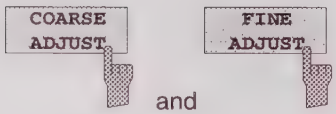


Either automatic adjustment:

➢ Press the *AUTO ADJUST* softkey. FSE/FSIQ sets the time reference between the trigger signal and the midamble and takes this reference into account for all measurements.

or manual adjustment:

(if automatic adjustment is not possible, eg for bursts without midamble or if option FSE-B7 is not installed.)



➢ Press the *COARSE ADJUST* softkey and set the time reference between the external trigger and the burst with the aid of the spinwheel. (Set the –20 dB point of the rising burst edge to the display center.)

➢ Press the *FINE ADJUST* softkey and perform fine adjustment of the trigger. ⑦

Additional information

Step 9

⑦

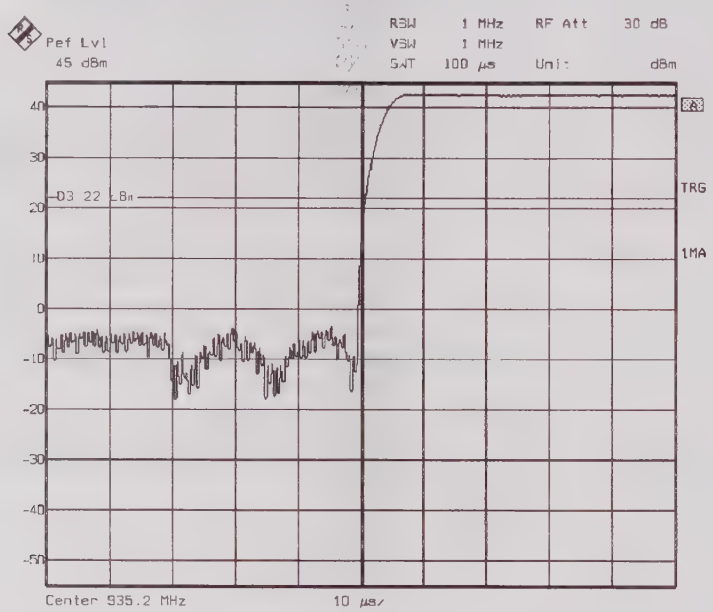
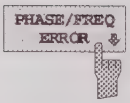


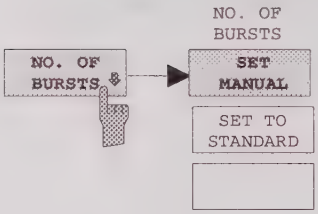
Fig. 1-2 Correct trigger adjustment by means of FINE ADJUST

Caution: *The manual adjustment to the -20 dB point of the trigger edge can deliver the correct time reference by approximation only since the high-precision reference to the midamble is missing and the setting thus depends on the slope of the burst edge. The automatic adjustment delivers the correct time reference to the midamble (depending on the burst edge slope the -20 dB point can be offset by up to approx. 7 µs from the screen center).*

1.3 Measurement of Phase/Frequency Error ①

Note: *Measurement of phase and frequency error is possible only if option FSE-B7 (Vector Signal Analyzer) is fitted. Otherwise, the softkey will not appear on the screen.*





Step 1

➢ Press the *PHASE/FREQ* softkey .

Step 2

➢ Press the *NO OF BURSTS* softkey and set the number of measurements to be carried out.

The number of bursts defined in the selected standard is set with SET TO STANDARD (in the phase/frequency error measurement: 20 for all standards).

Press ⌂ to return to the SETTINGS menu.

Additional information

① **MS setting:**

The measurement can also be performed on MSs with active SFH (slow frequency hopping). FSE/FSIQ measures at the set receive frequency (ARFCN). If a number of bursts > 1 has been set, only measurement results will be considered at which FSE/FSIQ is able to synchronize. Thus even if the carrier frequency of the slot to be measured changes cyclically in successive frames, only slots with the set midamble at the selected ARFCN will be considered in the measurement. However, this will considerably slow down the measurement sequence (approx. by the factor 3 against a non-hopping MS). This disadvantage can be avoided if a trigger signal is provided for the FSE/FSIQ (triggering not on every frame but only if the selected slot is at the set ARFCN).

The MS needs to receive a suitable synchronization burst from the system simulator for the frequency error to be measured correctly.

Step 3

➢ Starting the measurement sequence with *SINGLE* or *CONTINUOUS*.

When the measurement is completed, an overview of the numeric modulation errors is displayed in result window A for the 147 useful bits. ②

Additional information

Step 3

②

Phase/Frequency Error

ARFCN: 1 Status: FAILED
Frequency: 890.20000 MHz
Carrier Power: 20.00 dBm Trg to Sync Start: 255.9 µs
Ext. Att/Gain: 20.00 dB
No. of Bursts: 1

ERRORS	CURRENT	MAX HOLD	AVG	LIMIT	STATUS
Phase Pk	0.63 °	0.63 °	0.63 °	20.00 °	PASSED
Phase RMS	0.24 °	0.24 °	0.24 °	5.00 °	PASSED
Freq	-573.20 Hz*	-575.79 Hz*	-573.20 Hz*	0.10 ppm	FAILED

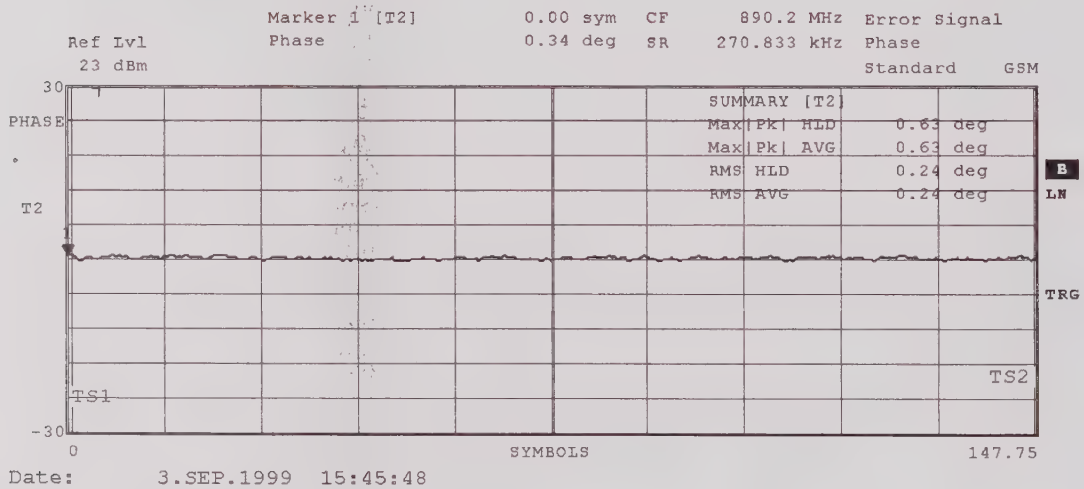


Fig. 1-3 Measurement window PFE

The information on instantaneous frequency and power and the following numerical results are displayed in the window. It also contains the corresponding limit values and pass/fail information.

Max hold and average value of peak phase error

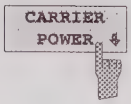
Max hold value and average value of rms phase error

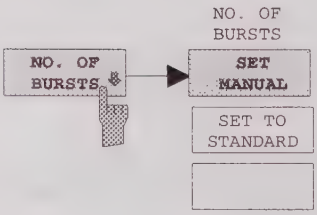
Max hold and average value of frequency error

Window B displays the phase error versus time, ie over the 147 useful bits of the normal burst. Three traces are displayed at the same time:

- Trace 1: Clear Write (instantaneous phase error)
- Trace 2: Max Hold (maximum positive phase error of all measured bursts)
- Trace 3: Min Hold. (maximum negative phase error of all measured bursts)

1.4 Measurement of Average Carrier Power ①





Step 1

➢ Press the *CARRIER POWER* softkey

Step 2

➢ Press the *NO OF BURSTS* softkey and set the number of measurements to be carried out.

The number of bursts defined in the selected standard is set with *SET TO STANDARD* (in the carrier power measurement): 1 for all standards.

Step 3

Possible only if option FSE-B7 is installed:

In the default setting, softkey *SYNC TO MIDAMBLE* is active and thus the synchronization to the burst midamble is set. This setting is of advantage if the burst to be measured contains a midamble and a bit-accurate time reference is required. (Softkey colour: green)

➢ Disable *SYNC TO MIDAMBLE* for bursts without midamble or if maximum measurement speed is required. (Softkey colour: grey) ②

Step 4

Setting the measurement bandwidth

➢ Press the *MEAS BANDWITH* softkey. A table indicating the settable bandwidths is displayed on the screen. Selecting STANDARD (default setting) sets the measurement bandwidth specified in the standard.
Or alternatively:
Select the measurement bandwidth 300 kHz or 1 MHz using the up/down keys and press the Enter key.

Additional information

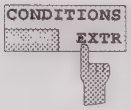
① **MS setting:**
The measurement may also be performed for slow frequency hopping of the MS, provided the option FSE-B7 is installed and SYNC TO MIDAMBLE is active on FSE/FSIQ.
For faster measurement, switch off SFH on the MS.

Step 3

② **Explanation of SYNC TO MIDAMBLE**

If option FSE-B7 is built in and the softkey is active, FSE/FSIQ uses the vector signal analyzer to synchronize to the midamble. Power measurement is performed in the scalar spectrum analyzer mode by means of the time reference obtained by the signal demodulation.

Thus an accurate and updated time reference is ensured (even with a jittered trigger pulse). If the softkey is not active, the vector analyzer mode is off and FSE/FSIQ uses the time reference set using ADJUST TRIGGER.

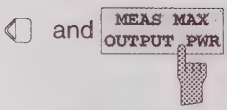


Step 5

➢ The tolerance range specified in the standards for the measurement is selected with the *CONDITIONS NORM/EXTR* softkey and thus adapted to the measurement conditions.

Default setting is NORM.

Step 6



➢ Press the ◁ key.

➢ Press the *MEAS MAX OUTPUT PWR* softkey.
The reference level is determined at maximum mobile power and the permissible tolerance against the level entered with the *POWER CLASS* softkey in the *MS TEST SETTINGS* menu.

Step 7

➢ The average carrier power is measured at incremented power control level and check for compliance with limit values (see step 8). To do so, the MS level must be reduced by one step each time in interactive mode and softkey *INCR STAT PWR CTRL* has then to be pressed for the measurement.③

➢ If this has been done for all power control levels, switchover from split-screen to full-screen table is made by pressing the *INC PWR CTRL LEVEL* softkey again.

Or alternatively step 8 (see text in the following)

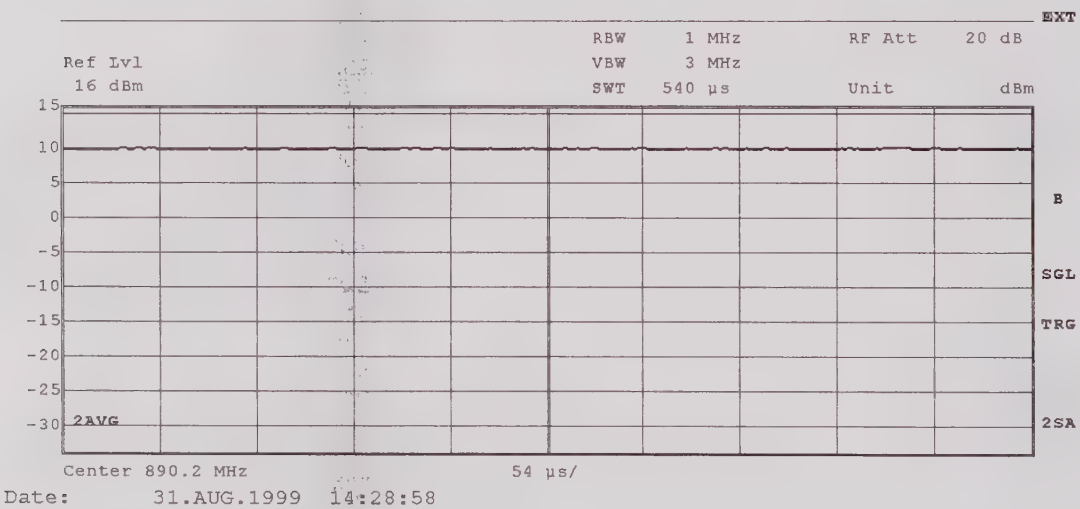
Additional information

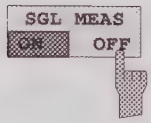
Step 7

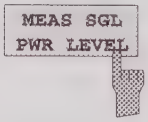
③ Upon completion of the measurement, a results table similar to the one below is displayed.

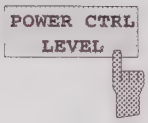
P-GSM 900 II CARRIER POWER(INDIVIDUAL)

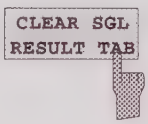
No	Pwr Ctrl Lvl	ABS POWER dBm	ARFCN	FREQUENCY	COND	EXT ATTEN dB	RBW kHz	BURST COUNT	MEAS POWER dBm	Status
1	11	21.00	1	890200000	NORM	20.00	1000	1	20.83	PASSED
2	11	21.00	1	890200000	NORM	20.00	1000	1	20.83	PASSED
3	12	19.00	1	890200000	NORM	20.00	1000	1	18.83	PASSED
4	12	19.00	1	890200000	NORM	20.00	1000	1	18.83	PASSED
5	13	17.00	1	890200000	NORM	20.00	1000	1	15.72	PASSED
6	13	17.00	1	890200000	NORM	20.00	1000	1	15.72	PASSED
7	14	15.00	1	890200000	NORM	20.00	1000	1	12.65	PASSED











Step 8

With the procedure as described for step 7, many power control levels have to be gone through even if only one power control level is to be measured.

If single power control levels are to be measured, proceed as follows:

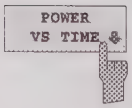
- Switch softkey *SGL MEAS* to *ON.*
- Select the power control level to be measured by pressing the *POWER CTRL LEVEL* softkey.
- Press the *MEAS SGL PWR LEVEL* softkey.
  The power measurement for this power control level is started.

The results obtained can be cleared from the table using softkey *CLEAR SGL RESULT TAB.*

The entries to be examined can be selected with the cursor keys and the spinwheel.

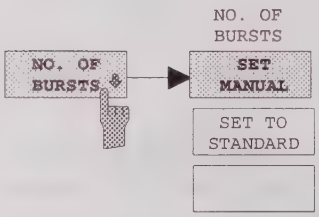
This page is left intentionally empty to ensure that the user's notes are always opposite to the additional information.

1.5 Measurement of Carrier Power versus Time ①



Step 1

➢ Press the *POWER VS TIME* softkey



Step 2

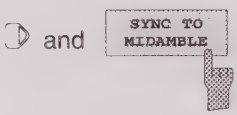
➢ Press the *NO OF BURSTS* softkey and set the number of measurements to be carried out.

The number of bursts defined in the selected standard is set with SET TO STANDARD (1 for all standards).

Step 3

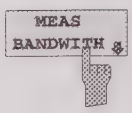
Possible only if option FSE-B7 is installed:

In the default setting, softkey *SYNC TO MIDAMBLE* is active and thus the synchronization to the burst midamble is set. This setting is of advantage if the burst to be measured contains a midamble and a bit-accurate time reference is required.



➢ Disable *SYNC TO MIDAMBLE* for maximum for bursts without midamble or if maximum measurement speed is required. ②

Step 4



Setting the measurement bandwidth

➢ Press the *MEAS BANDWITH* softkey. A table indicating the settable bandwidths is displayed on the screen. Selecting STANDARD (default setting) sets the measurement bandwidth specified in the standard.
Or alternatively:
Select the measurement bandwidth 300 kHz or 1 MHz using the up/down keys and press the Enter key.

Additional information

① **MS setting:**

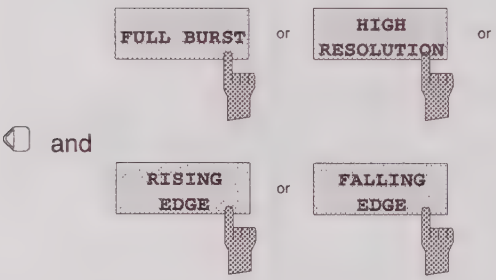
The measurement may also be performed for slow frequency hopping of the MS, provided the option FSE-B7 is installed and *SYNC TO MIDAMBLE* is active on FSE/FSIQ.
For fast measurement, switch off SFH on the MS.

Step 3

② **Explanation of SYNC TO MIDAMBLE**

If option FSE-B7 is built in and the softkey is active, FSE/FSIQ uses the vector signal analyzer to synchronize to the midamble. Power measurement is performed in the scalar spectrum analyzer mode by means of the time reference obtained by the signal demodulation.

Thus an accurate and updated time reference is ensured (even with a jittered trigger pulse). If the softkey is not active, the vector analyzer mode is off and FSE/FSIQ uses the time reference set using ADJUST TRIGGER.



Step 5

➢ Press *REF MEAS AUTO / USER* to select if a preview is to be performed prior to each measurement for the correct level adjustment of FSE/FSIQ or if the preview is to be started exclusively by the user using *START REF MEAS*.

Default setting is *REF MEAS AUTO*.

Step 6

➢ Select the resolution for the display of bursts.

- *FULL BURST*: The complete burst is displayed.
- *HIGH RESOLUTION*: The 147 useful bits are displayed with 1 dB level resolution.
- RISING EDGE: Display of the rising burst edge with high time resolution.
- FALLING EDGE: Display of the falling burst edge with high time resolution.

Step 7

➢ To start the measurement, press the *SINGLE* or the *CONTINUOUS* softkey.

The burst is displayed as selected in step 6.

Additional information

Step 7

③

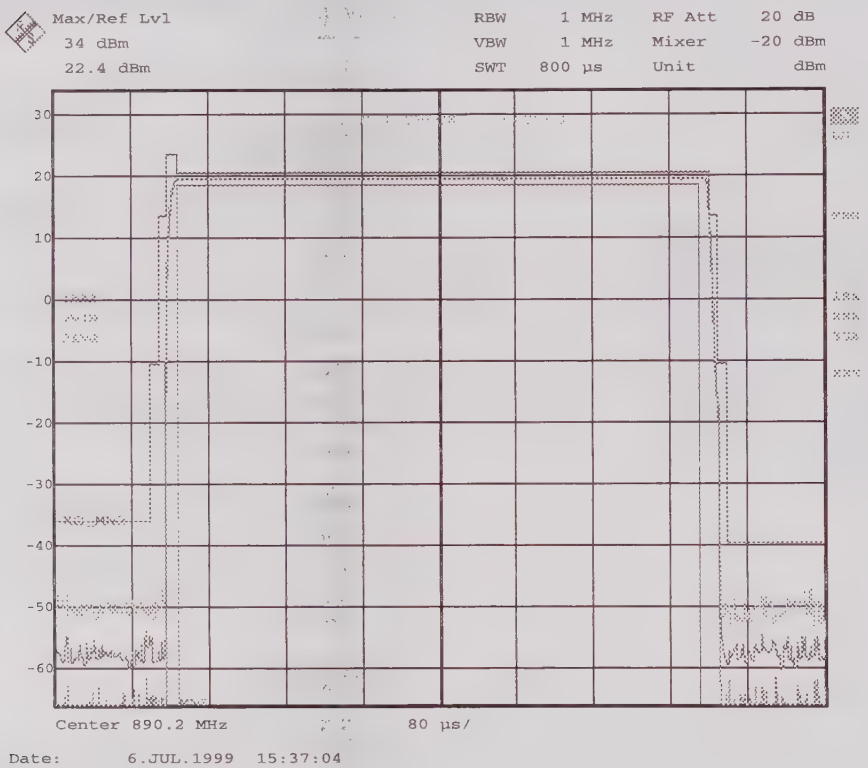
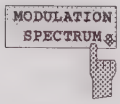


Fig. 1-4 Display of a *FULL BURST*

1.6 Measurement of Spectrum due to Modulation ①

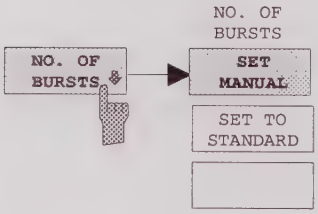
If SFH is activated, the center SFH channel prescribed by the standard is set automatically in FSE/FSIQ. If another frequency is to be used for the measurement, it can be set in the frequency menu (see chapter 3, Measurements with Option FSE-K10).

Note: *The measurement setup is described in chapter 1.1 and, in more detail, in chapter 3 (Measurements with Option FSE-K10).*



Step 1

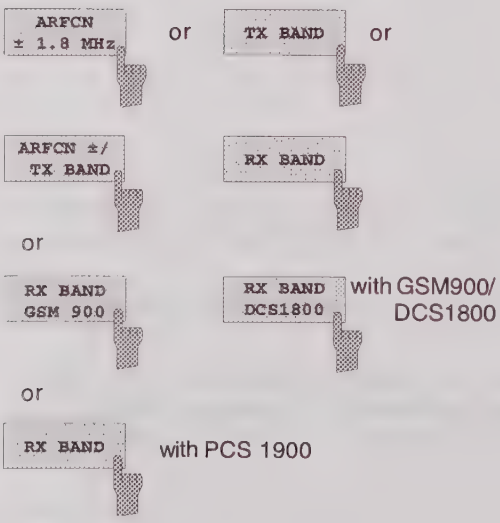
➢ Press the MODULATION SPECTRUM softkey. ②



Step 2

➢ Press the *NO OF BURSTS* softkey and set the number of measurements to be carried out.

The number of bursts defined in the selected standard is set with *SET TO STANDARD*.
This depends on the selected frequency band. ③



Step 3

④

➢ Select the frequency range for the measurement:
ARFCN ±1.8 MHz, *TX BAND*, *RX* BAND
or in the combined band
ARFCN ±1.8 MHz/TX band.

For GSM900 phase I, the measurement in *TX band* as well as the combined measurement *ARFCN +/TX band* is not carried out.

Caution: *Change of measurement setup for measurements in RX band.*

Additional information

① **MS setting:**

SFH (slow frequency hopping) is to be switched off.

Step 1

② As prescribed, the measurement is performed (excepting the midamble) from 50 to 90 % of the burst provided adjust trigger is set correctly in the Setting menu; step 9, ⑦.
If necessary, the setting can be checked and corrected by pressing the *ADJUST TRIGGER* softkey.
The measurement can be performed as a spectrum or, as described in the standards, as zero span measurement with subsequent output of the numerical results in a table.

Step 2

③ The preset number of bursts depends on the selected frequency range: ARFCN±1.8 MHz, TX band or RX band (for P-GSM900 phase 1, there is no measurement in the TX band).

	No. of Bursts
ARFCN ±1.8 MHz	200
TX band	50
RX band	50

Step 3

④ The stringent requirements for emission measurements in the RX band make it absolutely necessary to provide sufficient suppression (max. carrier level <-10 dBm at the FSE/FSIQ input) of the carrier signal, eg by means of a bandstop filter.

With RX BAND selected, FSE/FSIQ is set to 0 dB attenuation to achieve maximum sensitivity for the measurement.

The *RX BAND GAIN* softkey is for defining the gain of the external preamplifier (or, in case of negative values, the insertion loss of the diplexer and bandstop filter connected ahead of the analyzer), which is then taken into account in the FSE/FSIQ display. A preamplifier is normally not needed.

The attenuation of an external attenuator entered under *SETTING* is ignored in RX band measurements.

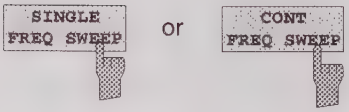
Caution: *The level of +20 dBm at the FSE/FSIQ input may under no circumstances be exceeded with 0 dB attenuation at the input attenuator.*

A warning to this effect is output when the *RX BAND* softkey is activated:

Caution:

Ext. attenuation ignored, disconnect ext. attenuator.

Connect bandpass or bandstop to suppress the TX band.



Step 4

➢ Start the spectral measurement either with *SINGLE FREQ SWEEP* or *CONT FREQ SWEEP*.⑤

Step 5

➢ Start the non-conforming measurement in the zero span by means of *START LIST*. ⑥

Additional information

Step 4

⑤ Spectral display is not possible in the combined band ARFCN ± 1.8 MHz/TX BAND (softkeys *SINGLE FREQ SWEEP, CONT FREQ SWEEP* are not active).

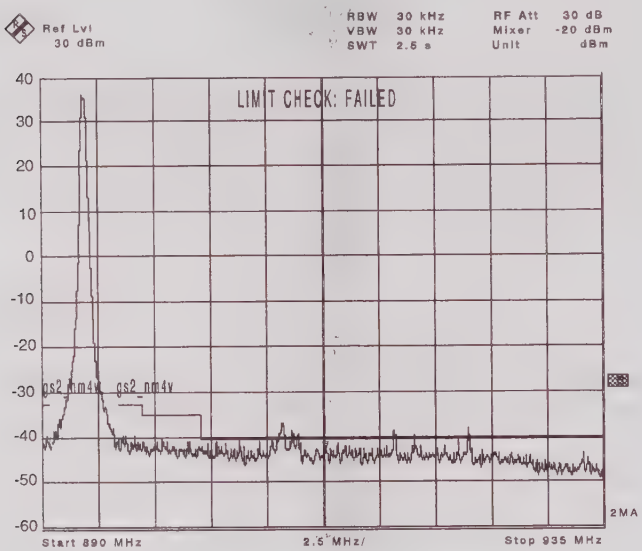


Fig. 1-5 Spectral display of spectrum due to modulation (*SINGLE FREQ SWEEP*) in the ARFCN ± 1.8 MHz range

Step 5

⑥

P-GSM 900 II	MODULATION SPECTRUM LIST			ARFCN ±1.8MHz	
ARFCN:	1		Status: FAILED		
Frequency:	890.20000 MHz				
Carrier Power:	20.0 dBm		Ext Atten:	20.0 dB	
Ref Pwr (RBW 30 kHz)	10.69 dBm		No of Bursts:	1	
No.:	Offset Freq:	+Offset	-Offset	Limit	Status
	100 kHz	-10.6 dB	-6.6 dB	0.5 dB	PASSED
1	200 kHz	-34.9 dB *	-35.6 dB *	-30.0 dB	MARGIN
2	250 kHz	-39.7 dB	-25.5 dB *	-33.0 dB	>FAILED<
3	400 kHz	-41.3 dBm*	-44.9 dBm	-36.0 dBm	MARGIN
4	600 kHz	-56.6 dB *	-64.2 dB *	-60.0 dB	EXC
	800 kHz	-92.2 dB	-91.3 dB	-60.0 dB	PASSED
	1000 kHz	-91.5 dB	-91.0 dB	-60.0 dB	PASSED
	1200 kHz	-90.6 dB	-91.8 dB	-60.0 dB	PASSED
	1400 kHz	-90.8 dB	-91.8 dB	-60.0 dB	PASSED
	1600 kHz	-91.8 dB	-90.7 dB	-60.0 dB	PASSED
	1800 kHz	-90.8 dB	-90.7 dB	-60.0 dB	PASSED

EXT

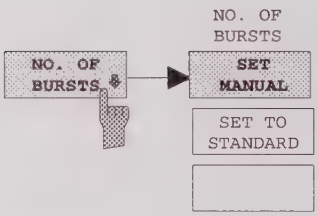
Fig. 1-6 Displayed results for zero span measurement (START LIST) in the ARFCN ±1.8 MHz range

1.7 Measurement of Spectrum due to Transients ①

Note: *The measurement setup is described in chapter 1.1 and, in more detail, in chapter 3 (Measurements with Option FSE-K10).*

Step 1

➢ Press the *TRANSIENT SPECTRUM* softkey.



Step 2

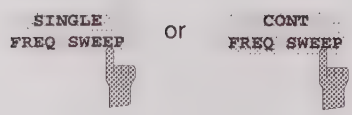
➢ Press the *NO OF BURSTS* softkey and set the number of measurements to be carried out.

The number of bursts defined in the selected standard is set with *SET TO STANDARD*.

Step 3

Setting the measurement bandwidth

➢ Press the *MEAS BANDWITH* softkey. A table indicating the settable bandwidths is displayed on the screen. Selecting STANDARD (default setting) sets the measurement bandwidth specified in the standard.
Or alternatively:
Select the measurement bandwidth 300 kHz or 1 MHz using the up/down keys and press the Enter key.



Step 4

②

➢ Press the *SINGLE FREQ SWEEP* or *CONT FREQ SWEEP* softkey. ③
The spectral measurement will be started.

Alternatively:

or

➢ Press the *START LIST* softkey to start the measurement in zero span ④.

Additional information

① **MS setting:**

The measurement can be performed with or without SFH (slow frequency hopping). The FSE/FSIQ test routines are devised to suit both cases.

Step 4

② The measurement can be performed as an overview frequency sweep showing the spectrum or as described in the standards, ie as zero span measurement with subsequent output of the numerical results in a table. In both cases, the maximum offset frequency of ±1.8 MHz marks the end of the measurement.

③

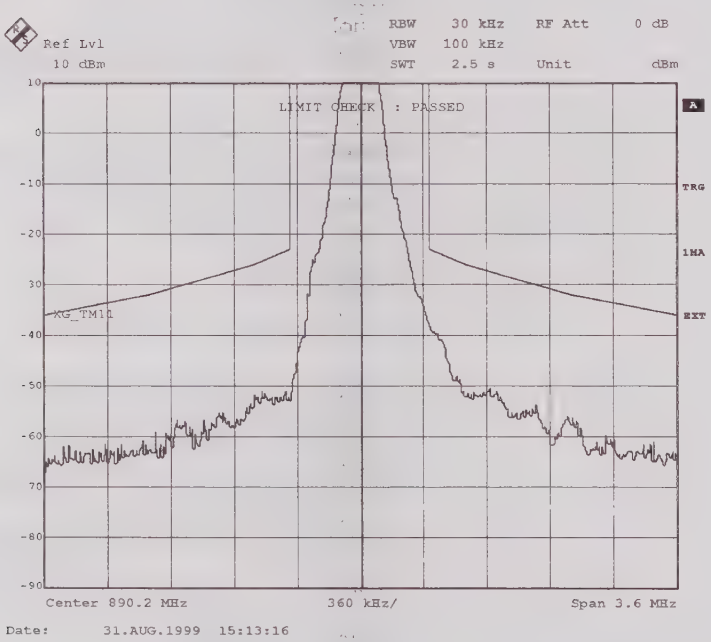


Fig. 1-7 Spectrum due to transients of a GSM mobile station measured in a frequency sweep. Limit lines and pass/fail information is shown.

④

P-GSM 900 II		TRANSIENT SPECTRUM LIST			
ARFCN:		1		Status: PASSED	
Frequency:		890.20000 MHz			
Carrier Power:		20.0 dBm		Ext Atten:	20.0 dB
Ref Pwr (RBW 300 kHz)		18.64 dBm		No of Bursts:	1
No.:	Offset Freq.	+Offset	-Offset	Limit	Status
	400 kHz	-39.0 dBm	-50.4 dBm	-23.0 dBm	PASSED
	600 kHz	-51.5 dBm	-52.2 dBm	-26.0 dBm	PASSED
	1200 kHz	-55.1 dBm	-60.8 dBm	-32.0 dBm	PASSED
	1800 kHz	-64.4 dBm	-62.8 dBm	-36.0 dBm	PASSED

Fig. 1-8 Output of the spectrum due to transient in the list mode. Measurement results, limits and pass/fail information for the offset frequencies stipulated in the standards as well as a general pass/fail information are shown.

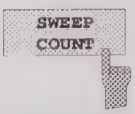
1.8 Measurement of Spurious Emissions ①

Note: *The measurement setup is described in chapter 1.1 and, in more detail, in chapter 3 (Measurements with Option FSE-K10).*

Step 1

➢ Press the *SPURIOUS* softkey.

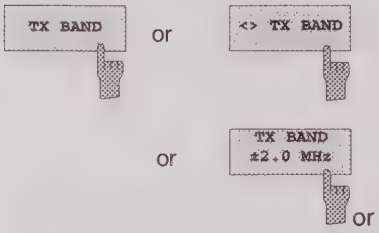
Step 2

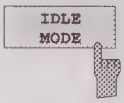


➢ Press *SWEEP COUNT* to define the number of sweeps that is to serve as a basis for averaging.

Additional information

① MS setting:
SFH can be used without restriction. However, it is advisable to switch off SFH of MS if the hopping frequencies are close to the band limits.





Step 3

➢ Determine the measurement range with *TX BAND*, *<> TX BAND* or *TX BAND ± 2.0 MHz*.

➢ With the aid of the *IDLE* softkey, you may also choose whether you wish to perform the measurement in the MS idle mode or in the "MS allocated a channel" mode.

➢ Other subranges can be selected or excluded in the used band using the *SELECT STEP* softkey.

Measurements in <> TX band:

For harmonics measurements, a carrier suppression of at least 25 dB is required to avoid the measurement of harmonics generated by FSE/FSIQ. The suppression can be performed using a highpass filter. In this case, switch also to TX SUPPR ON. FSE/FSIQ then increases its sensitivity by 20 dB (reference level reduced by 20 dB).

Note: *For measurements in the IDLE mode, the mobile has to be set continuously to the PAGING REORGANIZATION mode and BS_AG_BLKS to 0.* ②

Step 4

➢ Select between two settings for the analyzer sweep time using *SWEEPTIME*. The sweep time (very long in some cases) required by the selected standard can be set with *STD*. The minimum sweep time of the analyzer is set with *AUTO*.

Additional information

Step 3

② The paging reorganization mode is to be activated.

Note: *In the IDLE mode, sweep times are extremely long (up to 4700 s depending on the frequency range) because in this mode the reception of a paging TDMA frame by the mobile must be ensured for each measurement point (measurement frequency).*

Alternatively:

and

Step 5

- If a complete measurement is to be performed in the selected band (TX, <>TX, TX BAND ±2.0 MHz) or in the IDLE mode, press the *START LIST* softkey.
- Alternatively:
- For a ***step-by-step*** measurement of the individual frequency bands, press at first the *START LIST SGL STEP* softkey and then *CONT SGL LIST* for each further measurement.

After the measurement has been completed, a tabulated overview of results with limits and pass/fail information is displayed. ③

Additional information

Step 5

③

P-GSM 900 II	SPURIOUS LIST			TX Band
ARFCN: 1			Status: FAILED	
Frequency: 890.20000 MHz				
Carrier Power: 20.0 dBm			Ext Atten: 20.0 dB	

No.	Frequency	Level	Limit	Status
	892.00000 MHz --- 896.20000 MHz	-59.9 dBm	-42 dBm	PASSED
	896.20000 MHz --- 915.00000 MHz	-18.8 dBm	-42 dBm	>FAILED<
1	909.12265 MHz	-18.8 dBm	-42 dBm	>FAILED<
2	908.21844 MHz	-20.0 dBm	-42 dBm	>FAILED<
3	909.83848 MHz	-20.8 dBm	-42 dBm	>FAILED<
4	910.25291 MHz	-35.3 dBm	-42 dBm	>FAILED<
5	908.06774 MHz	-36.0 dBm	-42 dBm	>FAILED<
6	913.37996 MHz	-36.1 dBm	-42 dBm	>FAILED<
7	910.10220 MHz	-36.4 dBm	-42 dBm	>FAILED<
8	907.87936 MHz	-38.6 dBm	-42 dBm	>FAILED<

EXT

Fig. 1-9 Example of a spurious list

In addition to the general information at the top of the table including the general PASS/FAIL information, all frequency ranges, the maximum level measured in the range and the applicable range limit plus status information are listed.

A frequency range is defined by an identical RBW/VBW setting of the FSE/FSIQ and the same limit.

If the margin or the limit of a frequency range is exceeded, spurious frequencies with levels are listed in addition (with numbers).

2 General Information on Option FSE-K10, GSM MS Analyzer

Option FSE-K10 allows the following measurements to be performed on GSM900 (P-GSM, E-GSM and R-GSM), DCS1800 or PCS1900 mobiles in line with standards (GSM 11.10, GSM 11.10-DCS, GSM11.10-1 and J-STD-007 Air Interface) in a very convenient way:

- PFE Phase/frequency error
- CPW Carrier power
- CPI Carrier power individual
- PVT Power versus time
- MOD Modulation spectrum
- TRA Transient spectrum
- SPU Spurious emissions

This chapter gives basic information on the sequence of operations, settings and messages of the instrument. Details on the individual measurements will be found in chapter 3. The information given under "General Remarks" is not needed for normal test operation. It is intended to provide a better understanding of instrument settings and operations.

The option is called with the *MODE* key and the *GSM MS ANALYZER* softkey. A selection menu is offered according to the specific standards with a softkey assigned to each measurement. The presettings are performed in the submenu of the *SETTINGS* softkey or in the right side menu of each measurement.

Cold Start

A complete reset to default values is made.

Warm Start

The previous state is assumed to a large extent. This applies to parameter values as well as to the selected measurement. The settings specific to the type of measurement and band are made. The default measurement type (list/single) is selected. The result history is cleared, so the results of previous measurements are no longer available after a warm start !

Entering FSE-K10

Re-entering
Action: Exiting FSE-K10 via the *MODE* menu, changing to non-FSE-K10 mode, re-entering FSE-K10.
The procedure is the same as for the warm start except for the result history which remains stored.

Changing between FSE-K10 and FSE-K11
Action: Switching between FSE-K10 and FSE-K11 via the *MODE* menu.
The response is the same as for a cold start.

Changing within FSE-K11

Changing the standard
Each change of standard causes a complete reset to the default values valid for the standard in question. The reset is performed without any warning to the user.

Changing the phase
Changes of phase are performed with as few modifications as possible.

If problems due to incompatible output data are detected during a phase change, the associated group of parameters is reset to default values. In such case a message is output for a limited time informing the user on the modifications performed.
With IEC/IEEE-bus control, the response is the same as with a change of standard !

Possible problems and resulting actions:

Change of frequency group: *There are no problems to be expected.*

Level group: If the power class or the power control level does not exist in the new phase, the parameters assigned to the level group are set to default values.
Warning: "OutputPower & ExtAtten set to Default!"

Measurement type and band: The procedure is the same as for a change of measurement type (see below).

Changing the measurement type/band

Measurement type
When the measurement type is changed (eg from spurious to spectrum due to modulation), initialization actions (basic settings) specific to the selected measurement type are performed once. A default band or the band last active is selected. List measurement (for spurious, spectrum due to transients, spectrum due to modulation) or single measurement (phase-frequency error, power versus time) can be selected as a measurement type. In the case of the carrier power menu being entered, the measurement last active is selected as measurement type.

Change of band
If the band is changed, no visible responses take place as a rule.
No other settings or initializations are made.

2.1 Sequence of Operations of FSE-K10 Measurements

Measurements performed with FSE-K10 can be divided into 2 types according to their sequence of operations:
Measurements with and without premeasurements.

a) **Premeasurement** ===> **Main measurement**
PreSettings [PostSettings] PreSettings PostSettings
[sequence data]

b) **Main measurement**
PreSettings PostSettings
[sequence data]

In the premeasurement, the currently applied signal level, which is essential for the main measurement, is determined as required for the selected measurement. This applies to all relative measurements (see below) which are related to a reference value. If the measured signal level is below a minimum value (value expected –20 dB), the measurement is interrupted at this point and a warning is output. Otherwise the subsequent main measurement is performed.

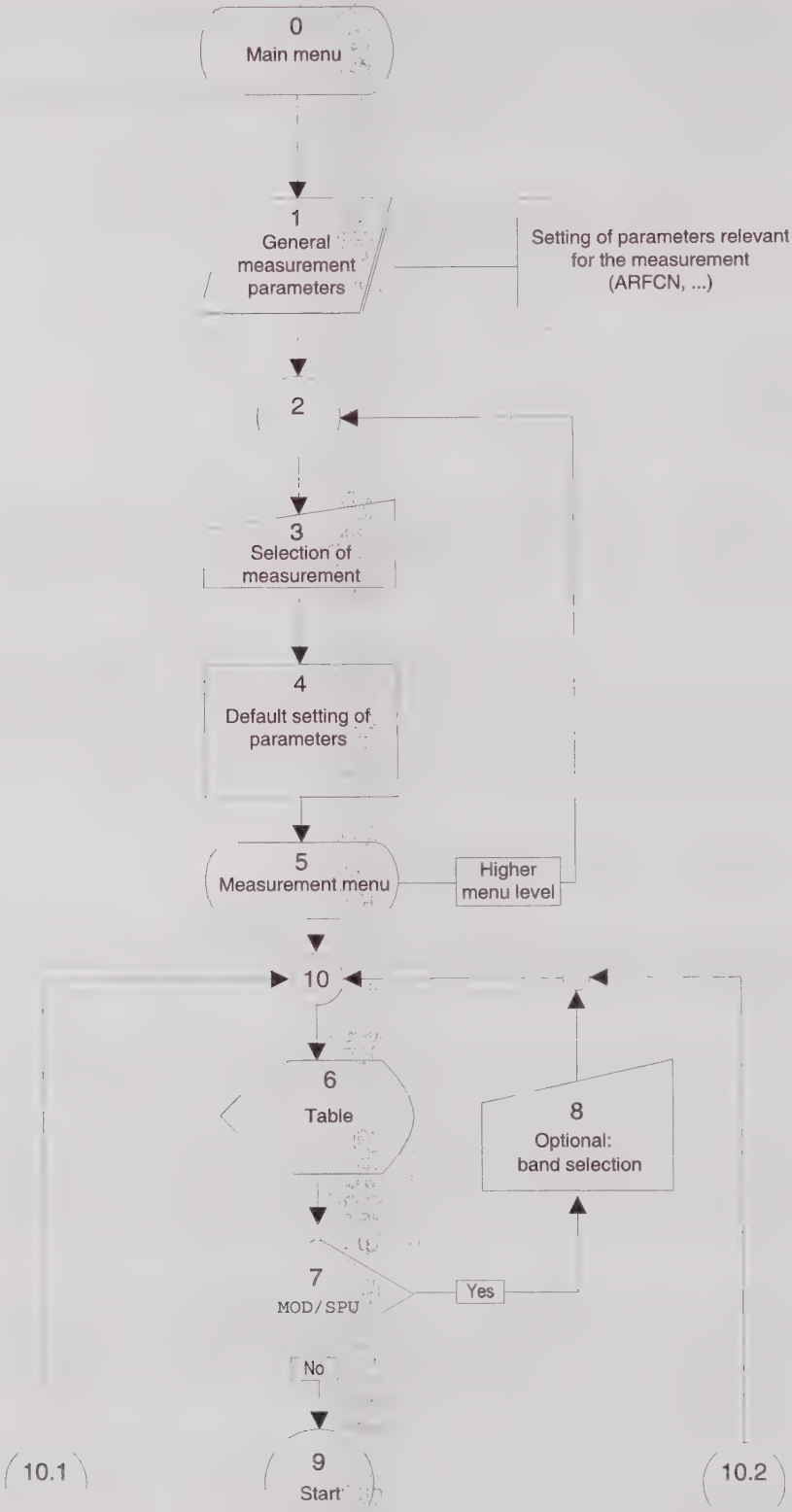
On activating a measurement menu, presettings are first performed which set the FSE/FSIQ to the default state required for the measurement type in question. On starting the measurement, the settings required for the selected measurement are carried out. The measurement is then performed in several consecutive steps, if necessary. At the end of the measurement, post settings (such as activating markers) are performed and the result is displayed.

2.1.1 General Description of FSE-K10 Measurements

The following diagram shows the sequence of operations of a measurement performed with FSE-K10. This diagram applies to all measurements except for the CPW/CPI measurement, which is shown on a separate diagram (see also chapter 3).

The desired measurement is selected in the main menu. General settings may be made before the selection of the measurement. Most parameters are also available for adjustments via the side menu of each measurement. On opening the measurement menu, general settings specific to the measurement concerned are performed once. In the basic menu for a given measurement, the results of the measurement last performed (table) are displayed in the full-screen mode (MOD, TRA, SPU, CPW) on calling up the menu. For the CPI, PVT and PFE measurements, on the other hand, the screen settings for the main measurement are activated immediately (for CPI the table cannot be displayed in the full-screen mode). For MOD and SPU the band can be selected. The table contents change depending on the selected band.

The measurement start initiates the (first) premeasurement. After completion of the premeasurement, the measured signal level is evaluated. In the go case, a second premeasurement is performed (for PVT) with optimum sensitivity or the main measurement with level setting related to the premeasurement. The result is displayed at the end of the measurement.


0
Main menu
1
General measurement parameters
Setting of parameters relevant for the measurement (ARFCN, ...)
2
3
Selection of measurement
4
Default setting of parameters
5
Measurement menu
Higher menu level
10
6
Table
8
Optional: band selection
7
MOD/SPU
Yes
No
9
Start
10.1
10.2

Explanation of Legend:

0 Entering the main menu of FSE-K10/K11 – It is possible to select general settings (SETTINGS) or to select a measurement directly .

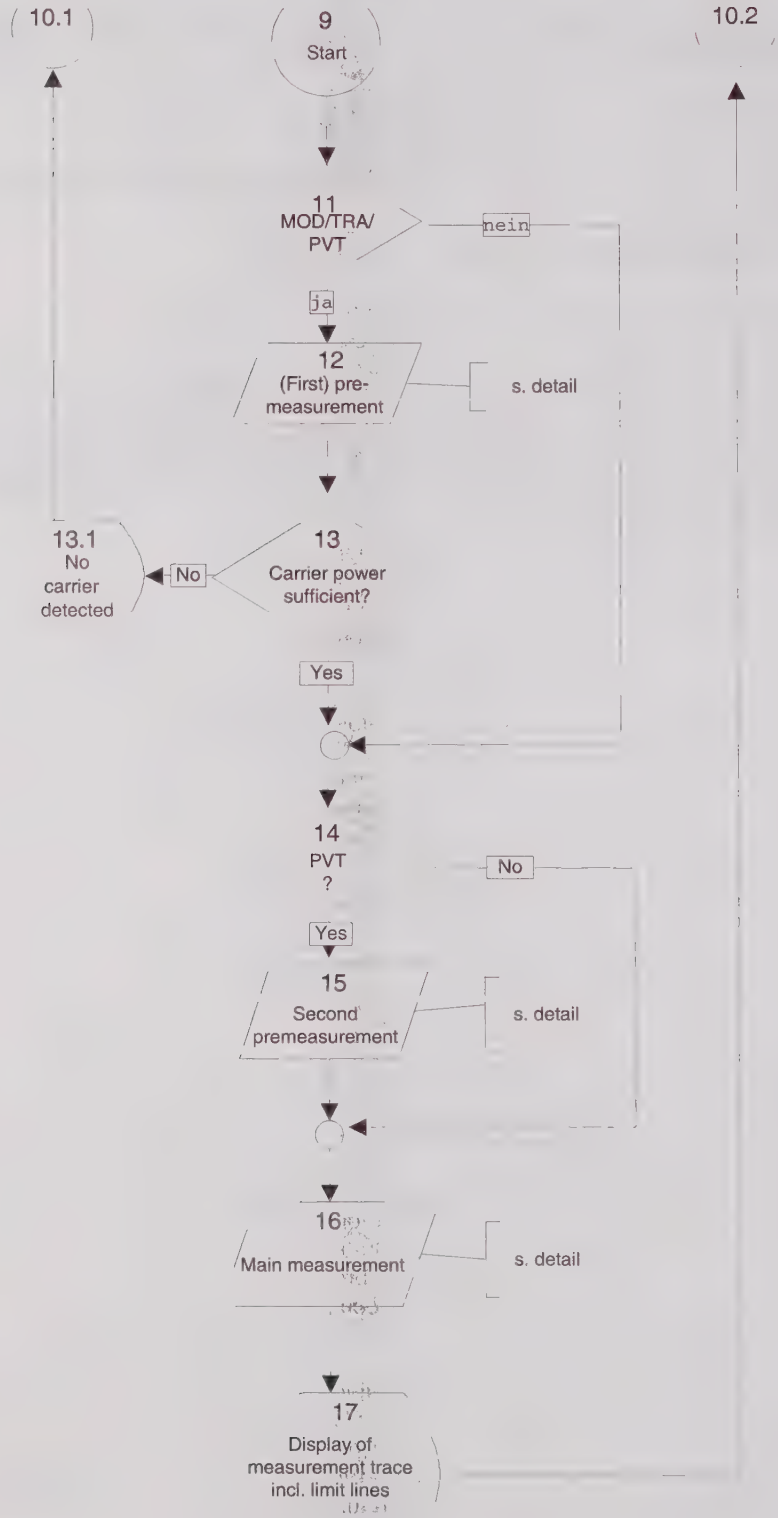
1 General settings for GSM measurement (ARFCN, attenuation, power, trigger, ...).

2 Main menu – Possibility of selecting one of the FSE-K10/K11 measurements PFE-CPW/CPI-PVT-MOD-TRA-SPU.

3 Selection of desired measurement via main menu.

4 The FSE assumes the default setting provided for the selected measurement.

5, 6,7,8 In the basic menu for a given measurement, the results of the measurement last performed (table) are displayed in the full-screen mode (MOD, TRA, SPU, CPW) on calling up the menu. For the CPI, PVT and PFE measurements, on the other hand, the screen settings for the main measurement are activated immediately (for CPI the table cannot be displayed in the full-screen mode). For MOD and SPU the band can be selected. The table contents change depending on the selected band.


10.1
9
Start
10.2
11
MOD/TRA/
PVT
nein
ja
12
(First) pre-
measurement
s. detail
13.1
No
carrier
detected
No
13
Carrier power
sufficient?
Yes
14
PVT
?
No
Yes
15
Second
premeasurement
s. detail
16
Main measurement
s. detail
17
Display of
measurement trace
incl. limit lines

Explanation of Legend:

9 Start of measurement with 'Single', 'Continuous' or 'StartList'.

11 For measurements TRA/PVT and MOD (not Rx band) the (first) pre-measurement is performed; for measurements PFE, CPW/CPI, MOD-Rx and SPU the main measurement is started immediately.

12 The sequence of operations of a (pre-)measurement is presented in detail in a separate diagram.

13 Sufficient carrier power: the measured signal level (incl. bandwidth correction) may be max. 20 dB below the signal level to be expected from the settings made.

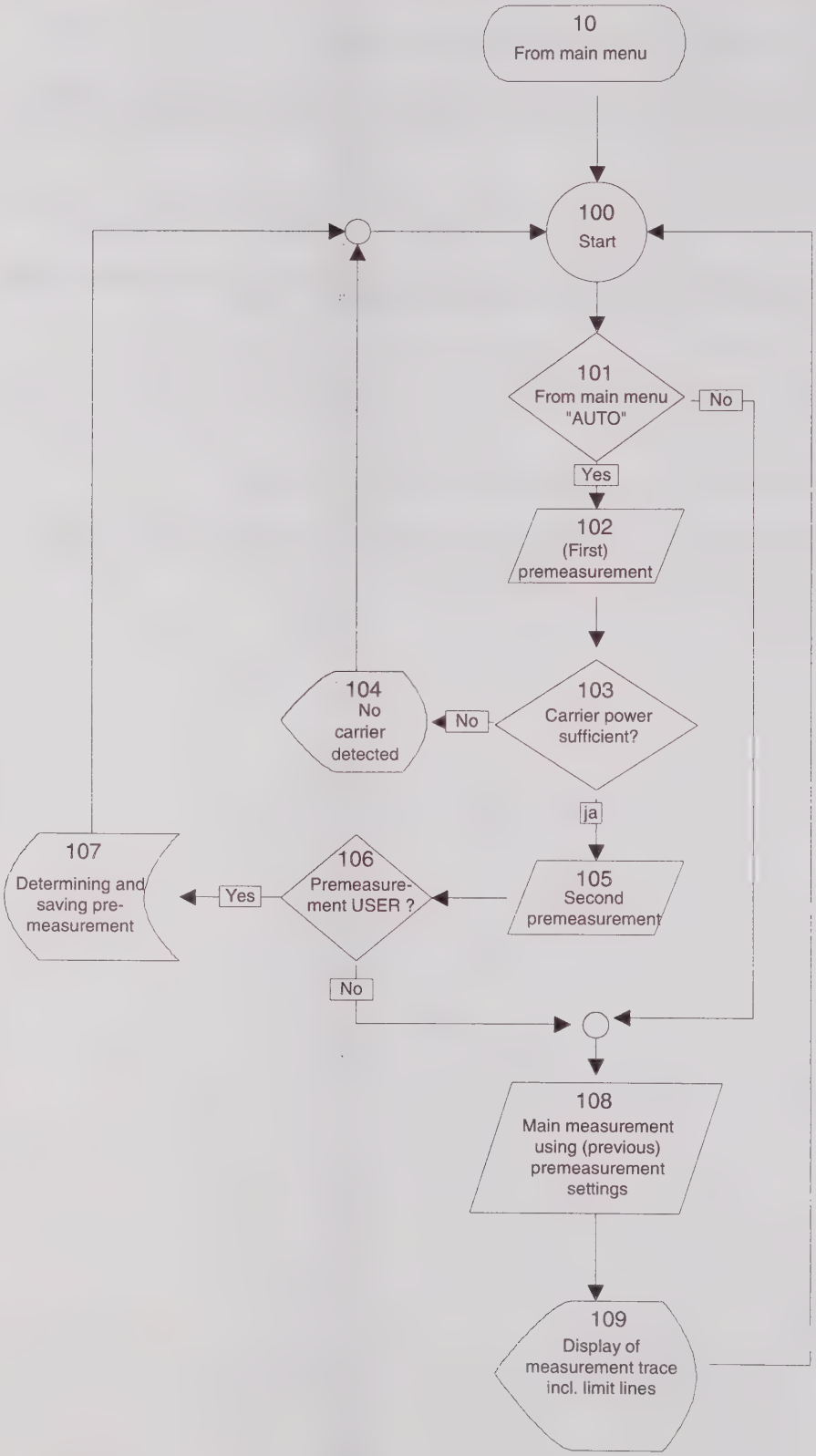
13.1 An error message is displayed temporarily and the IEC/IEEE status bit is set.

14, 15 Following the premeasurement, a second premeasurement is performed for PVT to accurately determine the reference.

The second premeasurement is performed with optimum sensitivity.

16 Main measurement with level control orientated to premeasurement. The sequence of operations is presented in detail in a separate chart

19 The result is displayed as a table or a trace.


10
From main menu
100
Start
101
From main menu "AUTO"
No
Yes
102
(First) premeasurement
103
Carrier power sufficient?
No
104
No carrier detected
ja
105
Second premeasurement
106
Premeasure-ment USER ?
Yes
107
Determining and saving pre-measurement
No
108
Main measurement using (previous) premeasurement settings
109
Display of measurement trace incl. limit lines

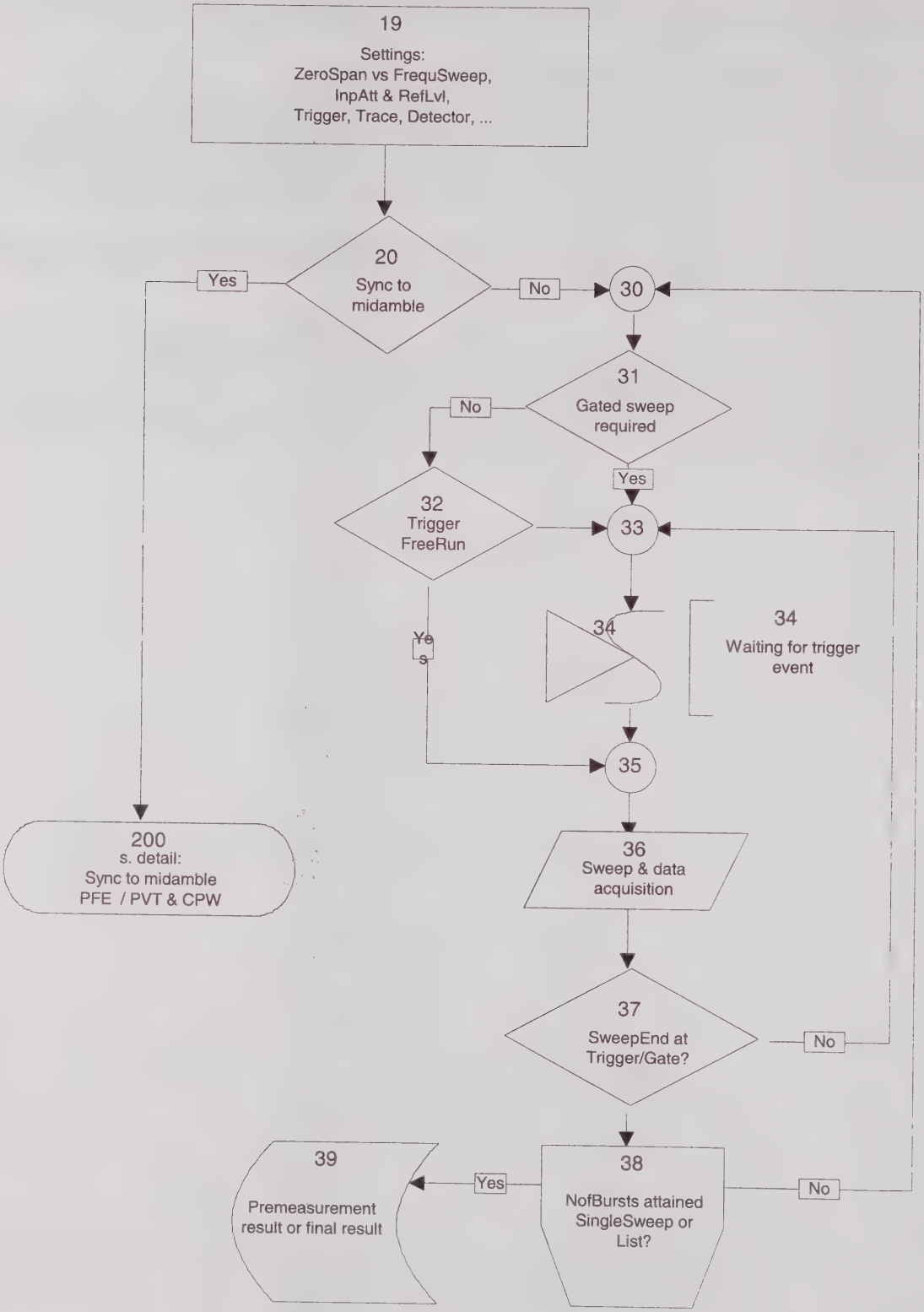
The above chart presents the PVT measurement in detail. The sequence of operations is determined by the setting for the premeasurement – *REF MEAS AUTO or REF MEAS USER*.

With the AUTO setting, the PVT measurement is performed as follows:

1st premeasurement - 2nd premeasurement - main measurement

The settings for the first premeasurement (with max. 2 measured bursts) are made in accordance with the expected level. The settings for the second premeasurement are made in accordance with the signal level determined in the first premeasurement, and level measurement is performed with max. 20 bursts. The signal level determined in the second premeasurement is used as a reference for the limit lines of the subsequent main measurement.
This two-stage procedure results in highly accurate level determination even in cases where the signal level is much below the expected value since, thanks to the follow-up level control, it is ensured that the measurement is always performed with optimum sensitivity.

In the USER setting, the premeasurements are skipped and the level resulting from the most recent premeasurement is used as the operating point setting and also as the limit line reference. If no level has been determined, the nominal value (expected signal level) is used.
This setting allows fast switching between the various burst views (Rising, Falling, Full, HighRes). Actuating the *START REF MEAS* softkey will trigger a sequence of two pre-measurements without any main measurement following.


19
Settings:
ZeroSpan vs FrequSweep,
InpAtt & RefLvl,
Trigger, Trace, Detector, ...
20
Sync to midamble
Yes
No
30
31
Gated sweep required
No
Yes
32
Trigger FreeRun
33
34
Waiting for trigger event
Yes
35
200
s. detail:
Sync to midamble
PFE / PVT & CPW
36
Sweep & data acquisition
37
SweepEnd at Trigger/Gate?
No
38
NofBursts attained SingleSweep or List?
No
Yes
39
Premeasurement result or final result

Looked at in detail, each (pre-)measurement consists of the following operations:

19 The settings needed for the intended measurement are made.

20 Synchronization to midamble is optional for PVT and CPW/CPI and mandatory for PFE. This choice is available only if Option FSE-B7 is fitted.

30-39 Measurement without digital demodulation (= option B7).

31,33 MOD measurements may require a "GatedSweep", ie a frequency sweep made only at specific times. For this purpose, an external gate signal (comparable to trigger) is indispensable.

32,33 Unless FreeRun was selected, the trigger event (external; optionally, for FSE-K10 also video or RF power) is required before continuing .

34 FSE-K10 waits for trigger event, then starts or continues the sweep.

35 The sweep is enabled.

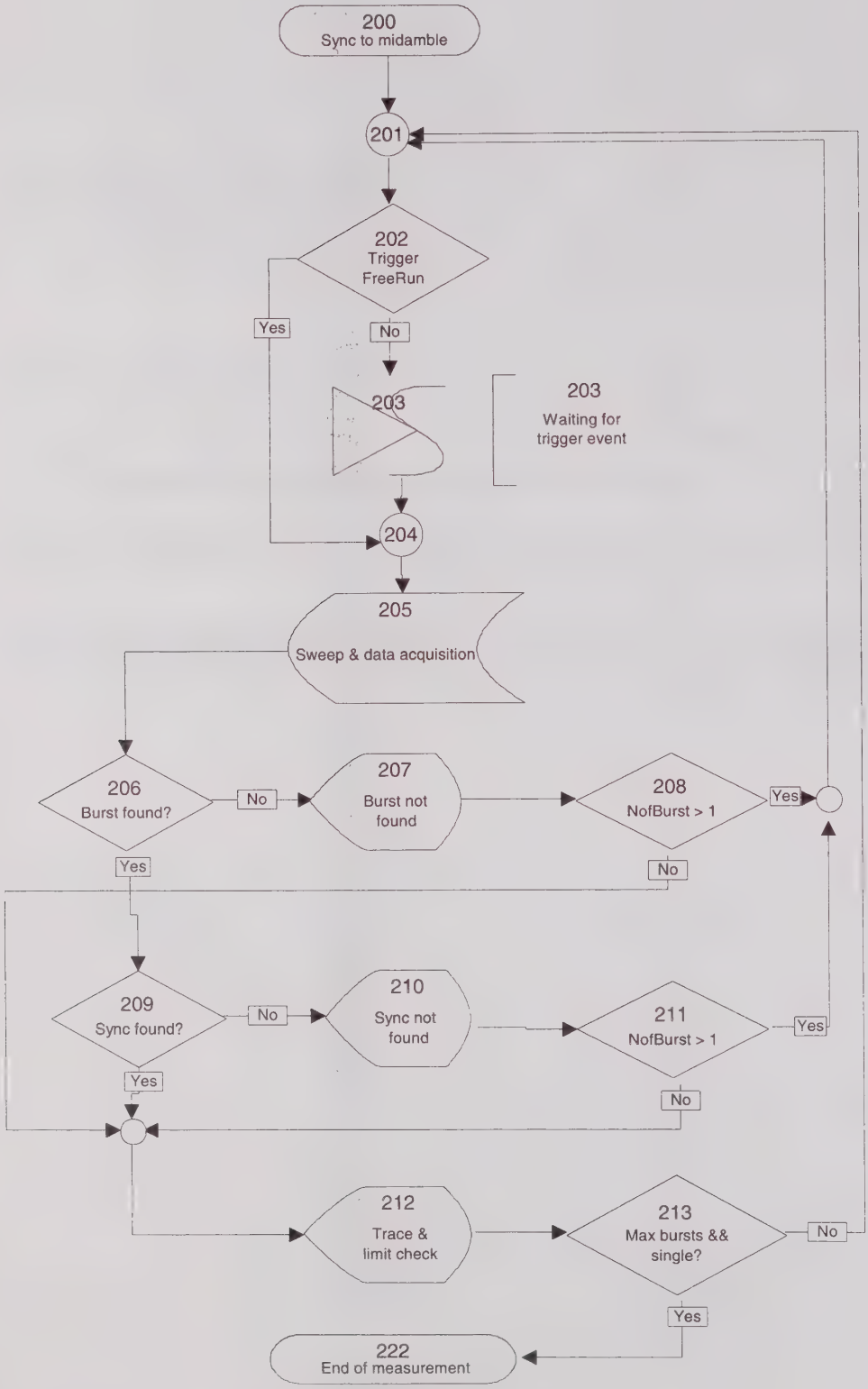
36 Collection of measured data until end of sweep or, with gated sweep, during a specific gate time.

37 Check if sweep is terminated.

38 Test: Check if number of preset sweeps has been attained AND if measurement is of Single type or List type.

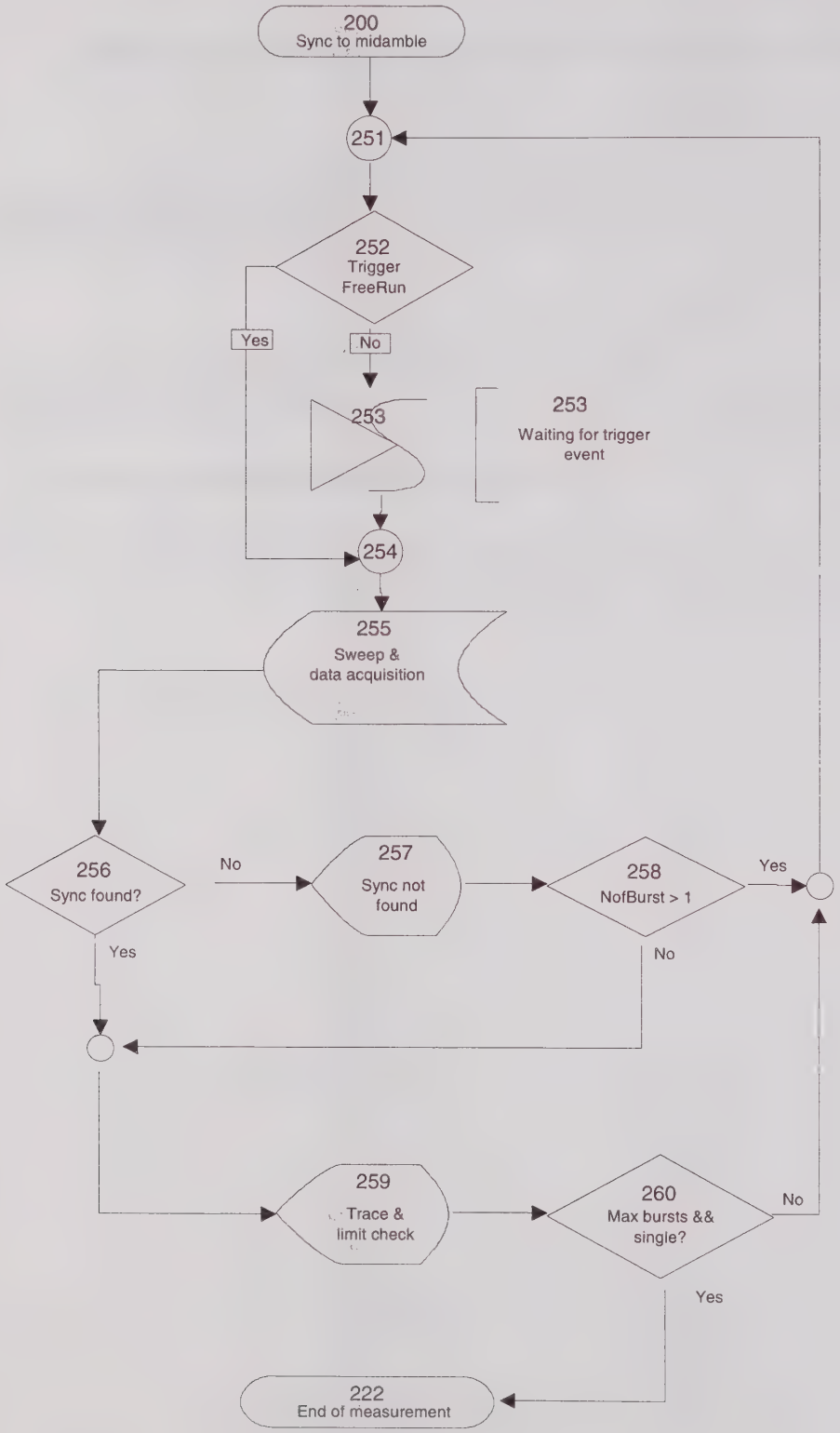
39 The measurement is completed if the preset number of sweeps has been attained and the measurement is of the Single type.

With digital demodulation, there are some differences as compared to the above sequence as far as the trigger logic is concerned. The sequence of operations with digital demodulation activated is shown in the following for PFE and PVT/CPW:


200
Sync to midamble
201
202
Trigger
FreeRun
Yes
No
203
203
Waiting for
trigger event
204
205
Sweep & data acquisition
206
Burst found?
No
207
Burst not
found
208
NofBurst > 1
Yes
Yes
No
209
Sync found?
No
210
Sync not
found
211
NofBurst > 1
Yes
Yes
No
212
Trace &
limit check
213
Max bursts &&
single?
No
Yes
222
End of measurement

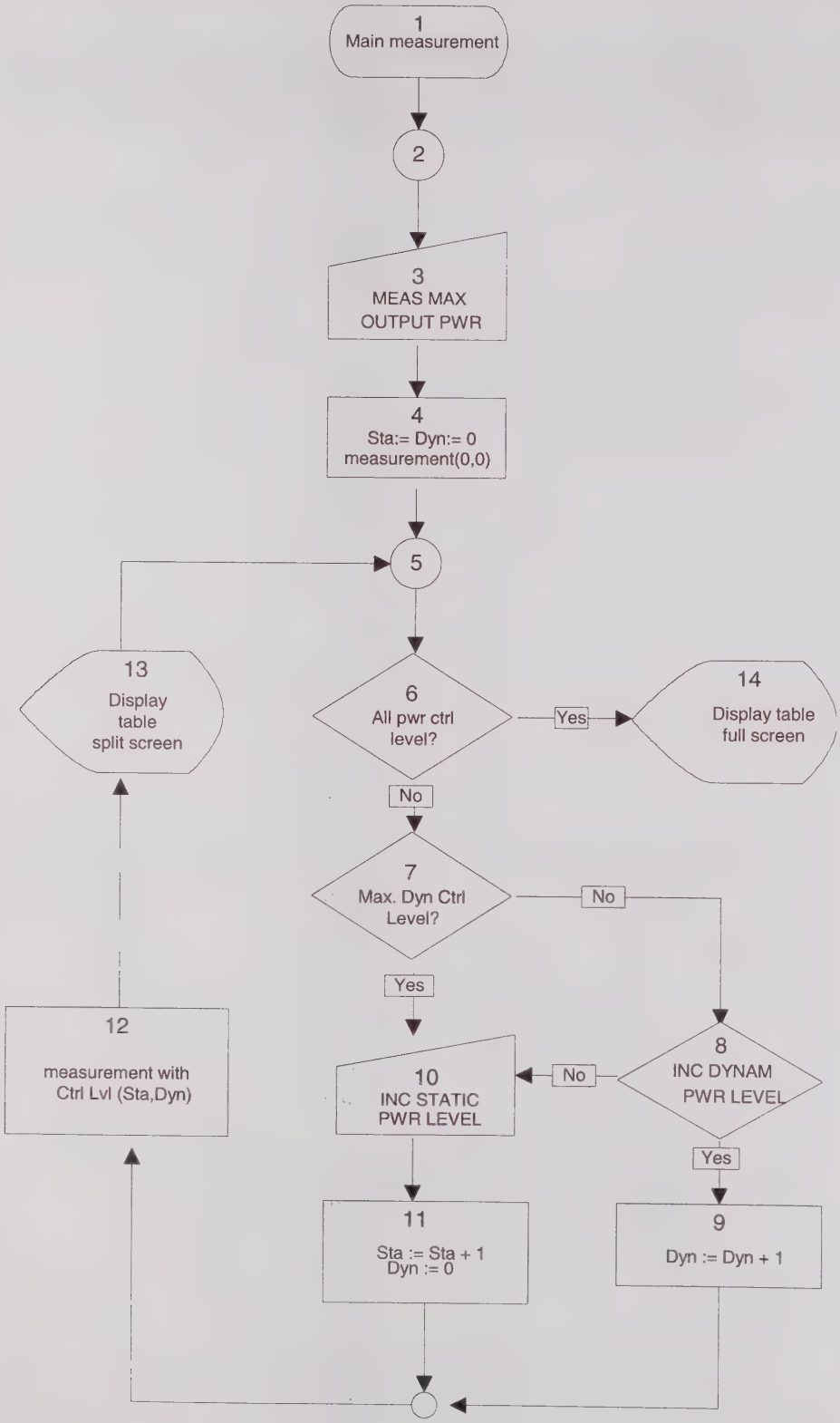
PFE sequence in detail:

200-204	Gated sweep is not possible – waiting for trigger event or FreeRun (not advisable).
205	Collection of measured data
206	Searching for bursts in a predefined time window (cf settings for result buffer).
207, 208	In case of an error, a message is output and the IEC/IEEE status bit 'Burst not Found' is set. In the special case of "NofBursts == 1", the error condition is ignored however during further processing.
209	Search for sync pattern in the selected burst
210, 211	In case of an error, a message is output and the IEC/IEEE status bit 'Sync not Found' is set. In the special case of "NofBursts == 1", the error condition is ignored however during further processing.
212	Evaluation of trace with numerical indication of the determined frequency error and phase error.
213	If the predefined number of bursts has been attained and the measurement has been started with 'Single', it ends at this point.


200
Sync to midamble
251
252
Trigger
FreeRun
Yes
No
253
253
Waiting for trigger
event
254
255
Sweep &
data acquisition
256
Sync found?
No
257
Sync not
found
258
NofBurst > 1
Yes
Yes
No
259
Trace &
limit check
260
Max bursts &&
single?
No
Yes
222
End of measurement

PVT/CPW sequence in detail:

The sequence of operations for PVT/CPW differs from that for PFE in that no burst search is performed. Only the sync pattern sequence (items 256 and 257) is searched in the recorded data stream within a limited range (compare "Settings") to determine a high-precision time reference. In the case of an error, the procedure is the same as for PFE, including the special case of "NofBursts == 1".


1
Main measurement
2
3
MEAS MAX
OUTPUT PWR
4
Sta:= Dyn:= 0
measurement(0,0)
5
6
All pwr ctrl
level?
Yes
14
Display table
full screen
No
13
Display
table
split screen
7
Max. Dyn Ctrl
Level?
No
Yes
12
measurement with
Ctrl Lvl (Sta,Dyn)
8
INC DYNAM
PWR LEVEL
No
10
INC STATIC
PWR LEVEL
Yes
11
Sta := Sta + 1
Dyn := 0
9
Dyn := Dyn + 1

The sequence of operations of a CPW measurement (BTS/K11) is described on the previous page.
The sequence of the CPW measurement for MS (FSE-K10) differs from that of the BTS by the replacement of the 2 power control stages by a single one which is swept in strict sequential mode.
The measurement is initiated by pressing the MEAS MAX OUTPUT PWR softkey. Then either the static or the dynamic power control level can be incremented as required. Each incrementation of the static power control level will reset the dynamic power control level to 0 (zero). If the initializing softkey MEAS MAX OUTPUT PWR is actuated during the current session, the session is aborted (measurement status: Aborted).
Entries by the user are controlled by the availability of softkeys INC STATIC PWR LEVEL and INC DYNAM PWR LEVEL. if the maximum value of the dynamic power control level is attained, the INC DYNAM PWR LEVEL softkey is inhibited so that only the static power control level can be increased. If the maximum value is attained here too, pressing the softkey again causes the session to be terminated and the total result to be displayed on the full screen.
In the 'full-screen table' status, both INC softkeys are inhibited and a new session can be started only by pressing the MEAS MAX OUTPUT PWR softkey.

Unlike the CPW measurement, the CPI measurement allows any single carrier-power measurements. In contrast to all other measurements of FSE-K10/K11, single measurements have no inherent relationship. There is no total result of the session. The CPI menu can be exited and activated any time without any effect on the table contents of the CPI measurement.
CPI measurements are mainly intended for development engineers in the lab who modify parameters of their workstation and want to investigate the effects thereof on the carrier power. CPW measurements, on the other hand, are aimed at complying with acceptance test specifications for the GSM standard.
CPI measurements, therefore, only evaluate absolute levels and make no relative comparisons between the levels of different power control level settings. Operator control is described by the additional hints following the description of the softkey menus.

The following overview gives a classification of the Kxx measurements according to the above diagram:

Measurement	Mode	Without premeasurement	With premeasurement	Sequence data	Remarks
KXX PFE	.....	XX		---	
KXX CPW	.....	XX		XX	
KXX CPI	.....	XX		XX	
KXX PVT	.....		XX	---	Possible without premeasurement depending on user settings Normally with two premeasurements
KXX MOD RX	Single, Cont	XX		---	
KXX MOD RX	List	XX		XX	
KXX MOD Tx, ARFCN ±1.8 MHz	Single, Cont		XX	---	Bandwidth correction necessary (see below)
KXX MOD Tx, ARFCN ±1.8 MHz	List		XX	XX	Bandwidth correction necessary (see below)
KXX TRA	Single, Cont		XX	---	PwrCoupling OFF: without premeas.
KXX TRA	List		XX	XX	PwrCoupling OFF: without premeas.
KXX SPU xxx	.....	XX		XX	

The spectrum-due-to-modulation measurements provide a reference value for the limit lines, which should be measured with a 30 kHz bandwidth. To evaluate the actual carrier power (ie the signal power measured with infinite bandwidth) a bandwidth-dependent correction value is added to the preview value: it is now 8 dB (analogous to GSM 05.50) for 30 kHz. The corrected value is also used for selecting the limit lines.

2.1.1.1 Errors and Failures During Measurements

There are three main sources of error in GSM measurements:

Carrier signal missing:

Causes: Wrong operating frequency (ARFCN), SFH active, test line defective or incorrect attenuation, wrong power class

Effects: Premeasurement: insufficient power measurement (eg average measurement with SFH), measurement is aborted.

Sweep stops (measurements with midamble synchronization)

Main measurement: sweep stops when midamble synchronization (PFE, PVT, CPW) is activated and number of bursts > 1. When signal is applied again, the sweep continues.

Trigger missing:

In all triggered measurements: sweep stops (indicated by trigger LED).
The following is recommended for the trigger source:

- External trigger: allows all measurements without restrictions.
- Video trigger: only measurements directly on the carrier are possible (PFE, PVT, CPW/CPI)
- RF power: TRA and MOD-ARFCN +/-1.8 MHz) are possible in addition to measurements for video.
- Free Run: permissible for SPU and TRA if no other trigger source is available.

Burst missing

Causes: dummy burst, SFH active, wrong frame trigger

Effects: In triggered measurements, limit lines may be exceeded (PVT);
sweep stops (in measurements with midamble synchronization).

2.1.2 Abort of Measurements

2.1.2.1 Abort by the User

In manual operation, each running measurement can be aborted by pressing the start softkey again (ie the key with which the measurement was initiated).
Starting another measurement likewise causes an abort of the running measurement. This also applies to switchover from Single to Continuous or List, for example.
Each measurement is also aborted on quitting the menu (new! As from 1.90 for all measurements) or modifying a test parameter (even in the side menu).

All aborts, except the spurious single step measurement, are without warning. Only if – during a running spurious single-step measurement – the user attempts to restart this measurement or to start the List measurement, is he queried prior to the restart being made.

For remote control, a special ABORT command is available which likewise causes the current measurement to be aborted (see manual for IEC/IEEE-bus control).

2.1.2.2 Abort by the Instrument

Measurements are normally performed until the end. Only in the case of insufficient carrier power (see above) are measurements aborted after the pre-measurement with an error message being output.
If the maximum number of table entries (50 at present) is exceeded in a spurious measurement, the measurement is continued but no other entry is made in the table. In CPI measurements, the last 40 single measurements are stored.

2.1.3 Results of Measurements

Measurement	Single result	Limit line	Table
PFE	Peak and RMS phase error; frequency error in 'ppm'		
CPW, CPI			One entry per single measurement: CPW: CtrlLevel, measured value and evaluation CPI: test parameter, measured value and evaluation
PVT		Upper & lower Limit line	
MOD Sgl		Upper limit line	
MOD List Rx/Tx			For each section: One 'Frequency'-'Level' entry for each event. One summary entry for each section (see below).
MOD List ARFCN ±1.8 MHz			One entry per pair of measurement: Frequency offset (+/-), level(-), level(+). Test points defined by standard.
TRA Sgl		Upper limit line	
TRA List			One entry per pair of measurement: Frequency offset (+/-), level(-), level(+). Test points at +/ -400, 600, 1200 and 1800 kHz.
SPU			For each section: One 'Frequency'-'Level' entry for each event. One summary entry for each section (see below).

The result tables of the MOD-LIST Rx/Tx and SPU measurements are arranged in groups:

The whole measurement range is divided into frequency sections.
A summary entry is generated for each section. This entry contains the section limits and the maximum level of the worst quality class measured in this section. All events are then listed as frequency-level pairs, an event being a measured value which lies above the limit or is at least in the tolerance range.

Measured values are assigned to one of the following quality classes:

- PASSED best quality class Results below the tolerance
- MARGIN : values below the limit but in the tolerance range (user-defined)
- EXCEPTION : values above the limit but still below the limit provided for outliers
- FAILED worst quality class values violate the limit and also the permissible exceptions

All measured values except PASSES are events in the above sense.
The section entries (and the table as well) are assigned either PASSED or FAILED as total evaluation .

If the number of measured outliers exceeds in one section the value defined by the standard, the section is assigned FAILED even if all events are assigned EXCEPTION in the worst case.

The tables have 50 lines at maximum.
In some measurements, therefore, it may happen that "failed" is indicated as a summary evaluation in the table header although all visible entries in the table are evaluated "passed".
The reason for this is that the "failed" evaluation might not appear until line 50 and is therefore not visible.

2.2 Exiting FSE-K10

When FSE-K10 is exited, the status last active is stored so that the operating status can be restored as far as possible on re-entering. The FSE-K10 settings are largely transferred to the other operating modes to allow FSE-K10-conformal measurements also in the other operating modes as far as this is expedient.

FSE-K10 can be exited by:

- Power Off
- Preset (mit anschließender Mode-Auswahl)
- Taste *MODE* mit anschließender Mode-Auswahl

Power off
FSE-K10 is restarted (warm start) on power-up of FSE/FSIQ. FSE-K10 in this case is not exited but only interrupted.

Preset
The instrument is reset to a defined default state. This function is comparable to a cold start. For FSE-K10 this means: no re-activation of the last operating status on re-entering but activation of the default status. The target status of the instrument after a preset is clearly defined independently of the current FSE-K10 status:
Analyzer, Frequ-Sweep Cont, Full Span, ...

Change of operating mode
The last state is a function of the FSE-K10 output state and target mode. The parameters are set for the target mode in such a way that similar measurements to FSE-K10 are possible. For changing from FSE-K10 to the analyzer and vector analyzer modes, the following is defined:

Transformation of (FSE-K10) parameters:

Trigger
TrgSource compatible (if not available in target mode: FreeRun)
TrgLevel is taken over for all modes (if available).
TrgDelay corresponding to trigger last active.
TrgPolarity, TrgEdge/Level are taken over.

Level
ExtAtt is represented by RefLvl offset.
RefLevel is set directly.
RF attenuation is calculated in line with FSE-K10 (AUTO or by formula).
Caution: For RX measurements, the input attenuation is set to AUTO ===> **not to** 0 dB !

Frequency
For the zero span or the vector mode, the ARFCN frequency is set as the center frequency.
For the frequency sweep mode, the start and the stop frequency are selected in accordance with the band last selected:
for Tx/Rx band the corresponding band (possibly incl. +/- 2 MHz),
for TX ±1.8MHz the center frequency f(AFRCN) with a span of 3.6 MHz,
with SPU the last selected section (or more simply the whole band of the NTx measurement).

Screen
Full screen is taken for the analyzer mode, split screen for the vector analyzer split-screen mode (PFE).

Trace

Trace assignment in FSE-K10:

2	for single-trace measurements in LIST mode (trace 1 used for table)
1	for single-trace measurements in SINGLE/CONT mode
1,3,2	for PVT measurements with MAX Hold, Average, MIN Hold
2	for SPU measurements
1,3,4	for PFE measurements with MAX Hold, ClearWrite, MIN Hold
2	for CPW/CPI measurements (Average)

Trace assignment is maintained as far as possible.

For changing to other modes, the following is defined:
On exiting FSE-K10, the FSE-K10 operating status last active is stored by the newly selected mode (eg RECEIVER mode, or another mode) and activated again by this mode when FSE-K10 is re-entered.

2.3 Preset

FSE-K10 is reset to the default status. Then the following setting is assumed:
Analyzer default setting: Frequ-Sweep, FullSpan, SweepTime Auto, RBW/VBW Auto, Trigger Free Run, ...

2.3.1 Signal Analysis Mode

The target status assumed results from the FSE-K10 status last active (or the last measurement performed with FSE-K10, respectively).

PFE	as PVT
CPW/CPI	ZeroSpan; f=f(ARFCN); SweepTime 540 µs wg. Trace 2 is renamed trace 1 because of full-screen display.
PVT	ZeroSpan; f=f(ARFCN); SweepTime 800 µs or 100 µs
MOD	Frequ-Sweep; Span/Start-Stop acc. to Tx/ARFCN ±1.8 MHz/Rx; NON-Rx: trigger at FreeRun, plus gated sweep with gate length 170 µs. Otherwise trigger is taken over (setting analogous to CONTINUOUS measurement).
TRA	FrequSweep; span 3.6 MHz, f = f (ARFCN); sweep time in accordance with TRA formula (settings analogous to CONTINUOUS measurement).
SPU	Frequ-Sweep Continuous; Start-Stop FullSpan; SweepTime AUTO. Trigger is taken over. Trace 2 is renamed trace 1 because of full-screen display.

2.3.2 Vector Signal Analysis Mode

The PFE status of FSE-K10 (vector mode) is set irrespective of the FSE-K10 status: split screen with result table at the top and trace at the bottom.

2.3.3 Receiver Mode etc.

In the RECEIVER mode, the status is saved upon exiting FSE-K10 and reinstated upon re-entry.

2.4 General Remarks

In the case of the TRA, MOD and PVT measurements, a premeasurement is performed prior to the main measurement.
The premeasurement is used to define the reference point for the limit lines.
In the case of PVT, the premeasurement takes place in two stages. In the first premeasurement with max. 2 bursts, the actual level applied is determined. A second premeasurement with maximum 20 bursts is then performed, which serves to determine the exact reference point for the limit lines using the operating point optimally set with the result of the first premeasurement.

In the PFE, CPW and SPU measurements, on the other hand, fixed level values are used and thus no premeasurements are required.

"ExtAtt" (external attenuation) is taken into account in all measurements in the carrier or non-TX band, "RxGain" for all measurement in the RX band. The values have basically the same effect but are used separately. RxGain can be entered any time, not only for an activated RX band measurement.

In all measurements with Min, Max and Average display, three traces are activated only if the number of sweeps is higher than 1. Likewise, vector triggering operates correctly only if the number of sweeps is set to a value higher than 1 (this too is a feature of the basic unit). If this is not the case, an error message is output, for example "Sync not found" if the midamble is not detected, in which case there is no synchronization to midamble.

2.5 Defaults for Standard, Phase, Measurement

Standard: P-GSM
Phase: II
Measurement: SPU-Tx

Type of measurement/band assignment for initial selection of measurement:

PFE	CPW	PVT	MOD	TRA	SPU
Single	MeasMax	Full Single	ARFCN ±1.8 MHz List	List	Tx List

Table 2-1 Parameter values (MS)

Parameter	PGSM-I	PGSM-II	DCS-I	DCS-II	PCS	E-GSM	R-GSM
ARFCN	1	1	512	512	512	0	0
Frequ [MHz]	890,2	890,2	1710,2	1710,2	1850,2	890,0	890.0
ARFCN min/max	1-124	1-124	512-885	512-885	512-810	975-1023 0-124	955-1023 0-124
ExtAtt [dB]	20	20	20	20	20	20	20
PwrClass	2	2	1	1	1	2	2
PwrCtrLvl	2	2	0	0	0	2	2
OutputPwr [dBm]	39	39	30	30	30	39	39
PwrCoupling	ON	ON	ON	ON	ON	ON	ON
SFH	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Tx suppression	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Limit margin [dB]	6	6	6	6	6	6	6
#Bursts	1	1	1	1	1	1	1
SFH ranges							
ARFCN SFH	62	62	573	573	573	13	13
ARFCN min/max	62-63	62-63	573-824	573-824	573-749	13-63	0-63
ARFCN-B/T	1/124	1/124	512/885	512/885	512/810	975/124	955/124

Table 2-2 General standard specifications

Bereich	Kanalnummern n	Frequenz Downlink (BS-->MS)	Duplex Offset
P-GSM	1 bis 124	f = 890 MHz + (n * 0,2 MHz)	+45 MHz
E-GSM	0 bis 124	f = 890 MHz + (n * 0,2 MHz)	+45 MHz
	975 bis 1023	f = 890 MHz + ((n - 1024) * 0,2 MHz)	+45 MHz
DCS1800	512 bis 885	f = 1710,2 MHz + ((n - 512) * 0,2 MHz)	+95 MHz
PCS1900	512 bis 810	f = 1850,2 MHz + ((n - 512) * 0,2 MHz)	+80 MHz
R-GSM	0 bis 124	f = 890 MHz + (n * 0,2 MHz)	+45 MHz
	955 bis 1023	f = 890 MHz + ((n - 1024) * 0,2 MHz)	+45 MHz

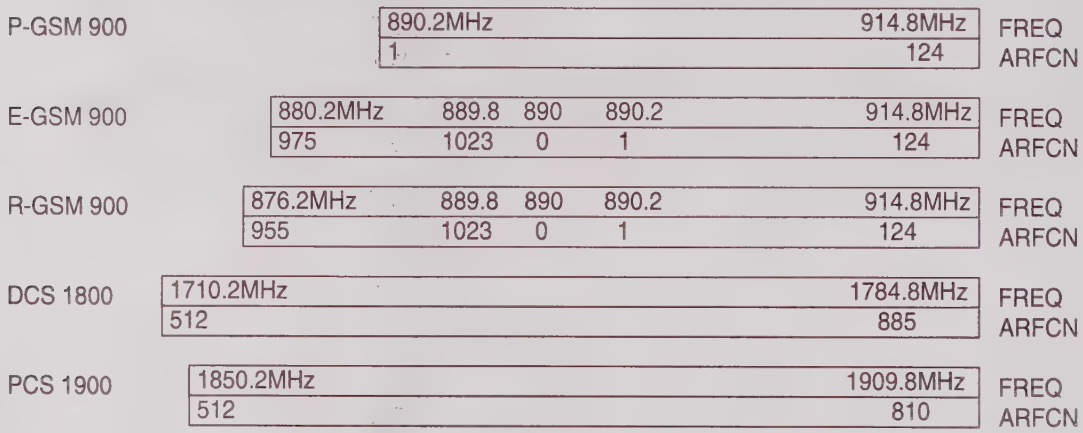


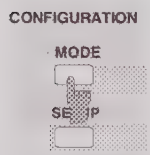
Table 2-3 Exceptions and base lines for MOD measurements

Standard	Range	Exceptions	Base line	concerning
PGSM-I	400 KHz to 1800 KHz		-36 dBm	
X-GSM	600 KHz to 6.0 MHz	3 to max -36 dBm	-65 dBm -59 / -64 / -69 dBm	PwrCls 1 to 8 PwrCls M1 / M2 / M3
	6.0 MHz to TX band	12 to max -36 dBm	-65 dBm -59 / -64 / -69 dBm	PwrCls 1 to 8 PwrCls M1 / M2 / M3
DCS-I	800 KHz to 6.0 MHz	3 to max -36 dBm	-57 dBm	PwrCls 1 to 4 (all)
	6.0 MHz to TX band	12 zu max -36 dBm	-57 dBm	PwrCls 1 to 4 (all)
DCS-II	600 KHz to 6.0 MHz	3 to max -36 dBm	-57 dBm -57 / -62 / -67 dBm	PwrCls 1 to 4 PwrCls M1 / M2 / M3
	6.0 MHz to TX band	12 zu max -36 dBm	-57 dBm -57 / -62 / -67 dBm	PwrCls 1 to 4 PwrCls M1 / M2 / M3
PCS	600 KHz to 6.0 MHz	3 to max -36 dBm	-57 dBm -57 / -62 / -67 dBm	PwrCls 1 to 4 PwrCls M1 / M2 / M3
	6.0 MHz to TX band	12 to max -36 dBm	-57 dBm -57 / -62 / -67 dBm	PwrCls 1 to 4 PwrCls M1 / M2 / M3

For details on the individual types of measurement please refer to chapter 3.

3 Measurements with Option FSE-K10

3.1 Starting the Application

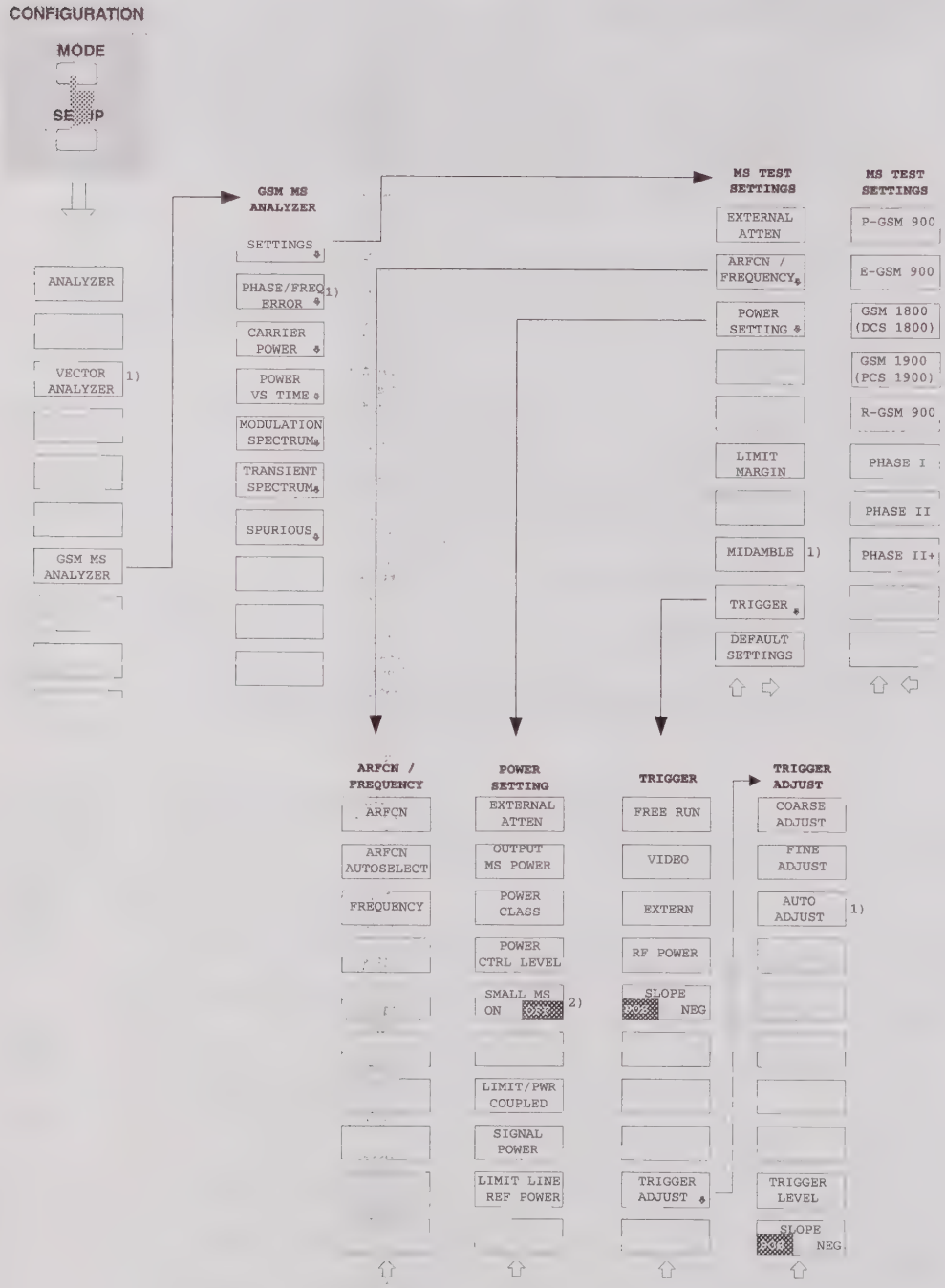


The application is called with the *MODE* key and the *GSM MS ANALYZER* softkey . A selection menu is offered according to the specific standards with a softkey assigned to each measurement. The presettings are performed in the submenu of the *SETTINGS* softkey or in the right side menu of each measurement.

All settings can generally be performed using the softkeys.
In addition, the following keys are available for performing special actions:

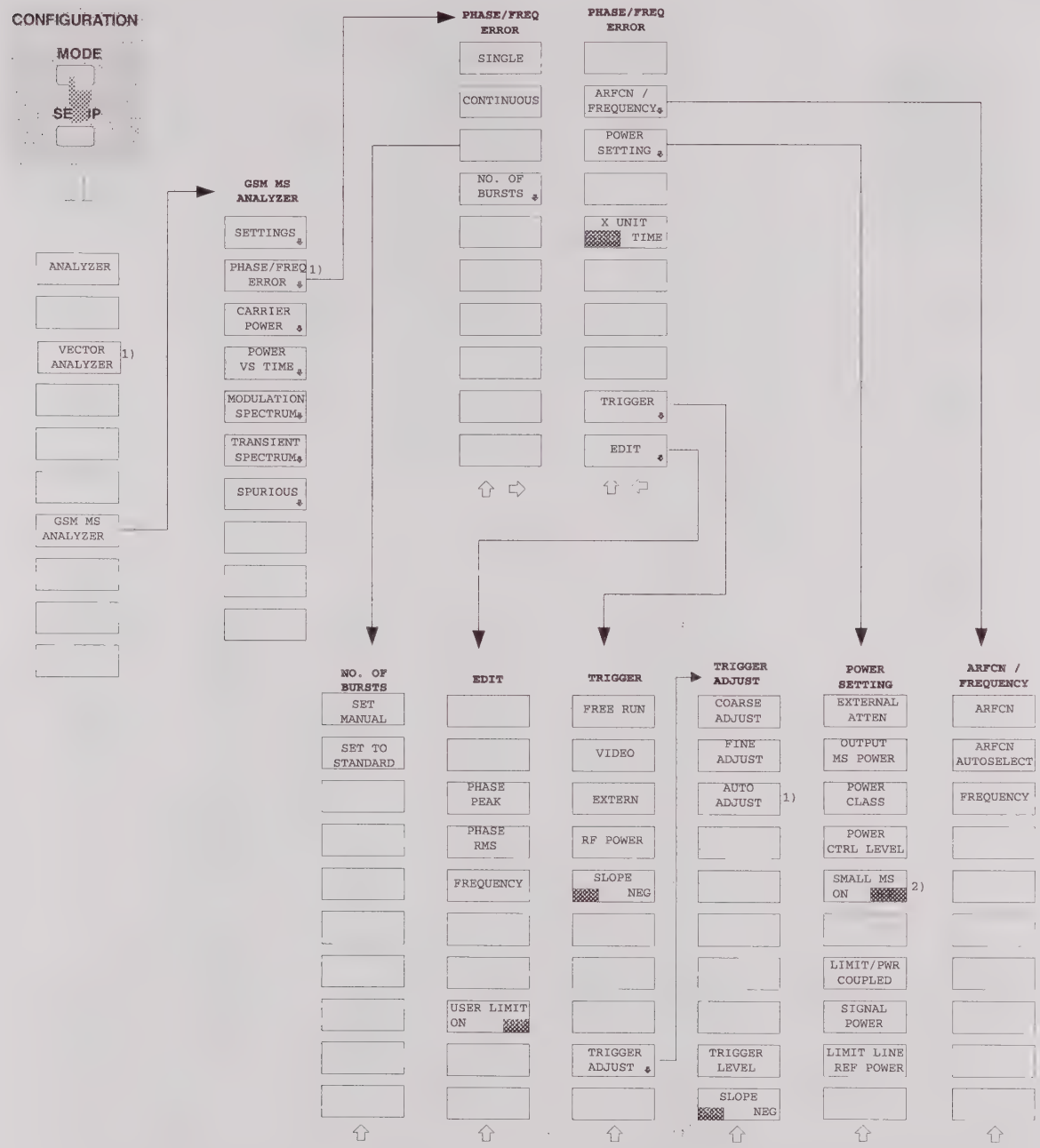
- Preset
- Print
- Save/recall
- Marker group (Normal, Delta)
- Marker-to-trace
- Marker info and search
- Display Line
- Time Line
- RefPoint (frequency/time, RefLevel/RefLevelOffset)

3.2 Menu Overview



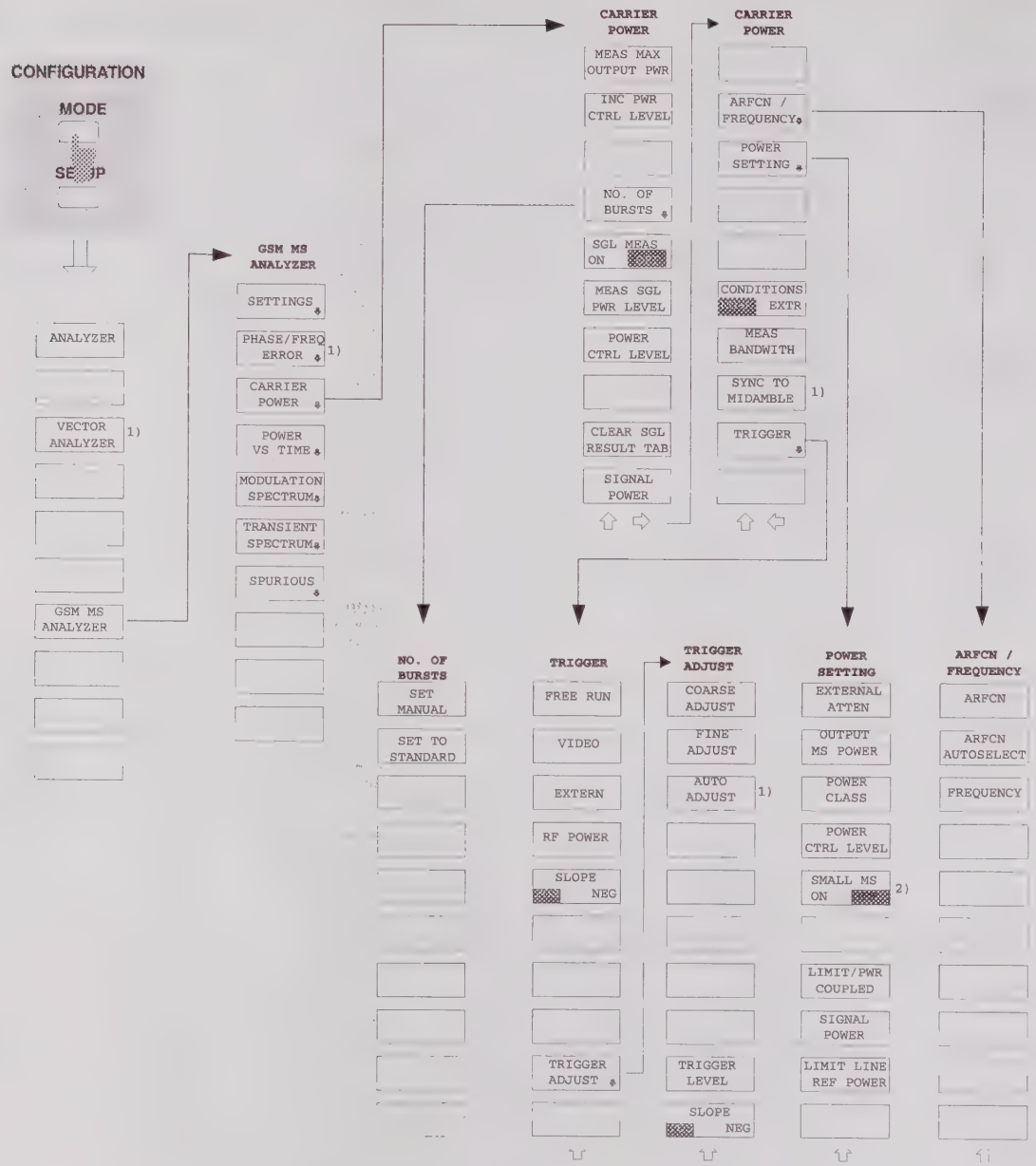
1) only with Option FSE-B7 (Vector Analyzer) installed

2) The "Small MS ON/OFF" softkey is available only for R-GSM (and DCS-II+); it serves for controlling the exceptions from the standard specifications that are permitted for "Small MS" (presently for SPU Tx limit only).



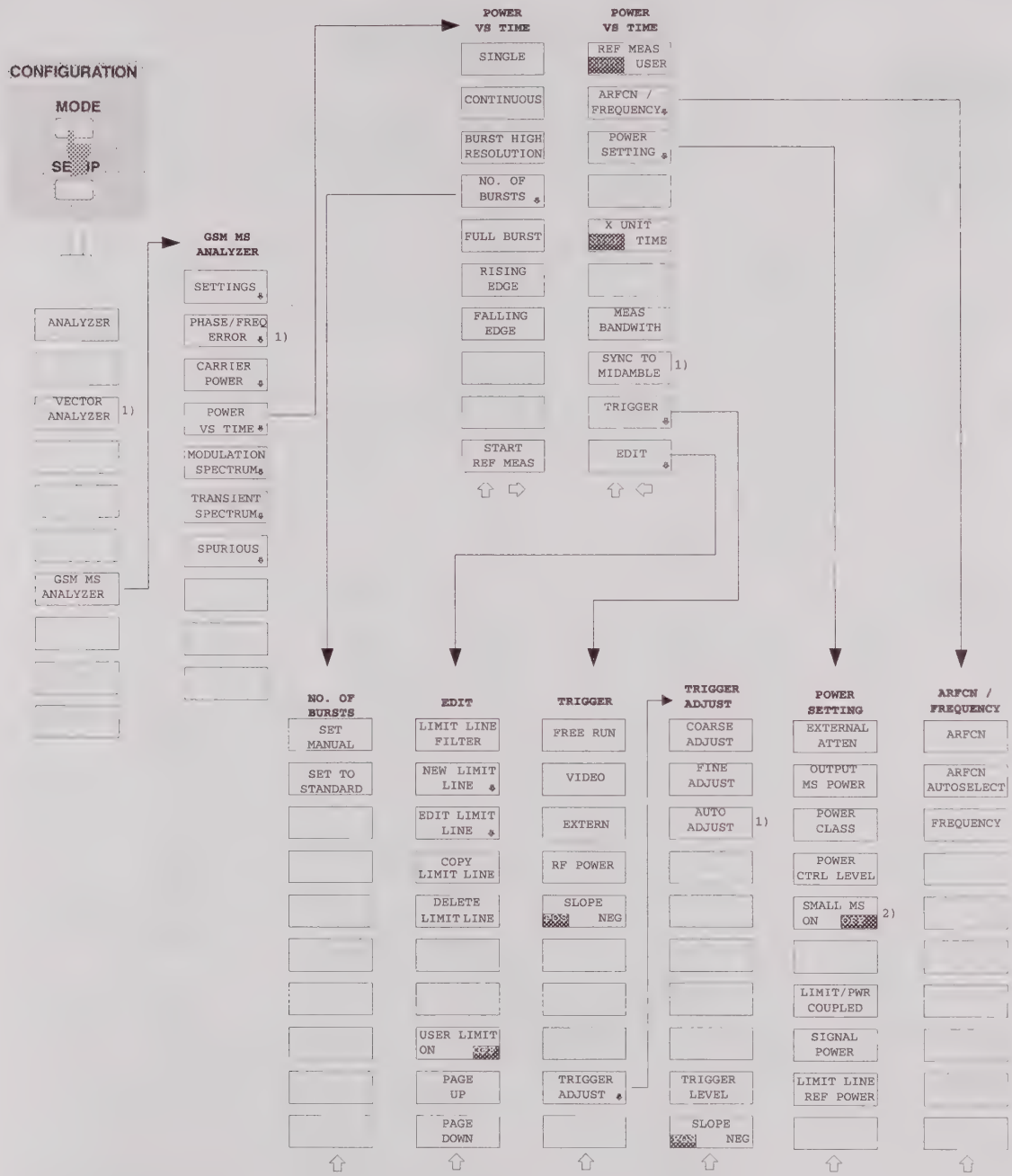
1) only with Option FSE-B7 (Vector Analyzer) installed

2) The "Small MS ON/OFF" softkey is available only for R-GSM (and DCS-II+); it serves for controlling the exceptions from the standard specifications that are permitted for "Small MS" (presently for SPU Tx limit only).



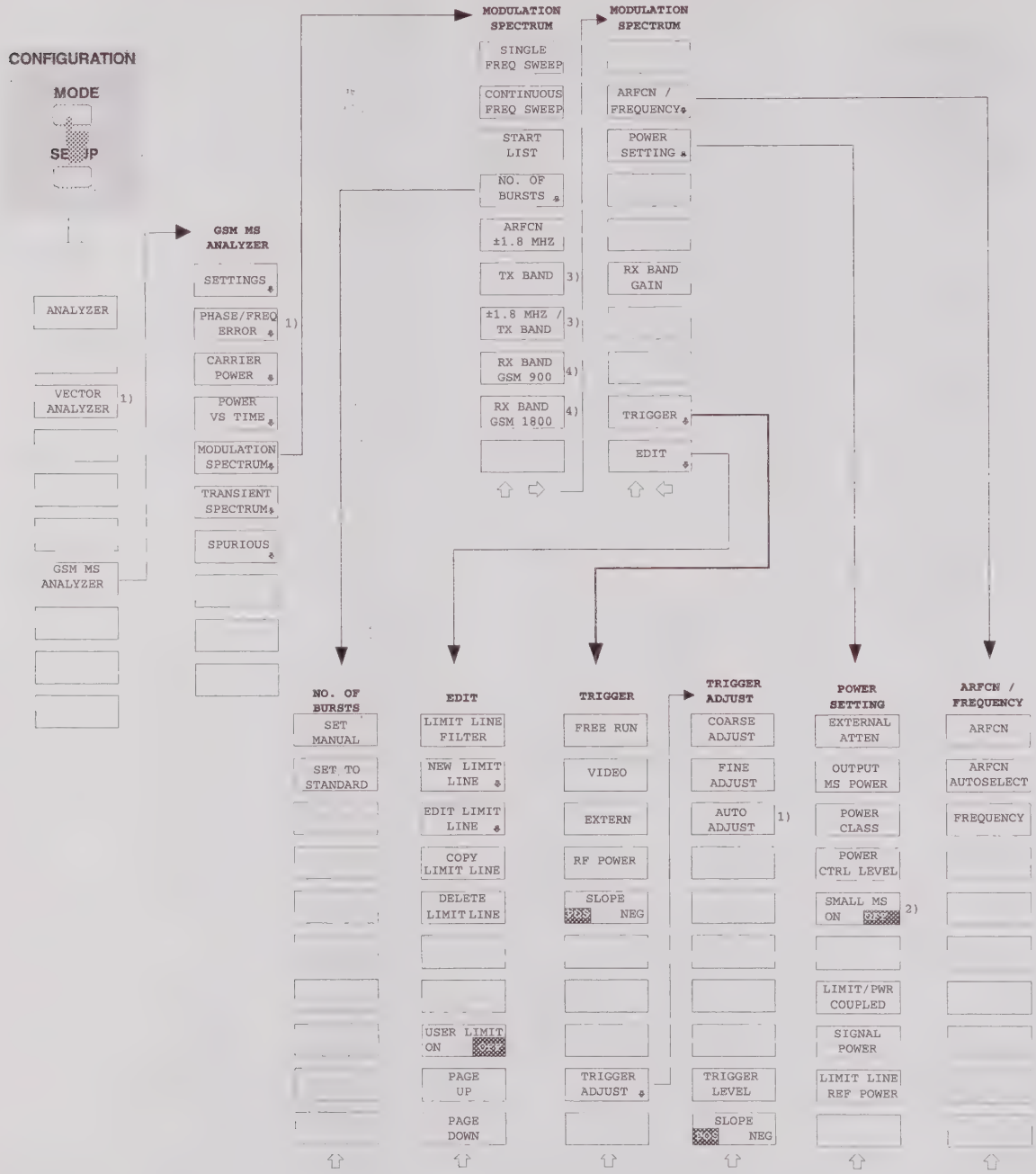
1) only with Option FSE-B7 (Vector Analyzer) installed

2) The "Small MS ON/OFF" softkey is available only for R-GSM (and DCS-II+); it serves for controlling the exceptions from the standard specifications that are permitted for "Small MS" (presently for SPU Tx limit only).

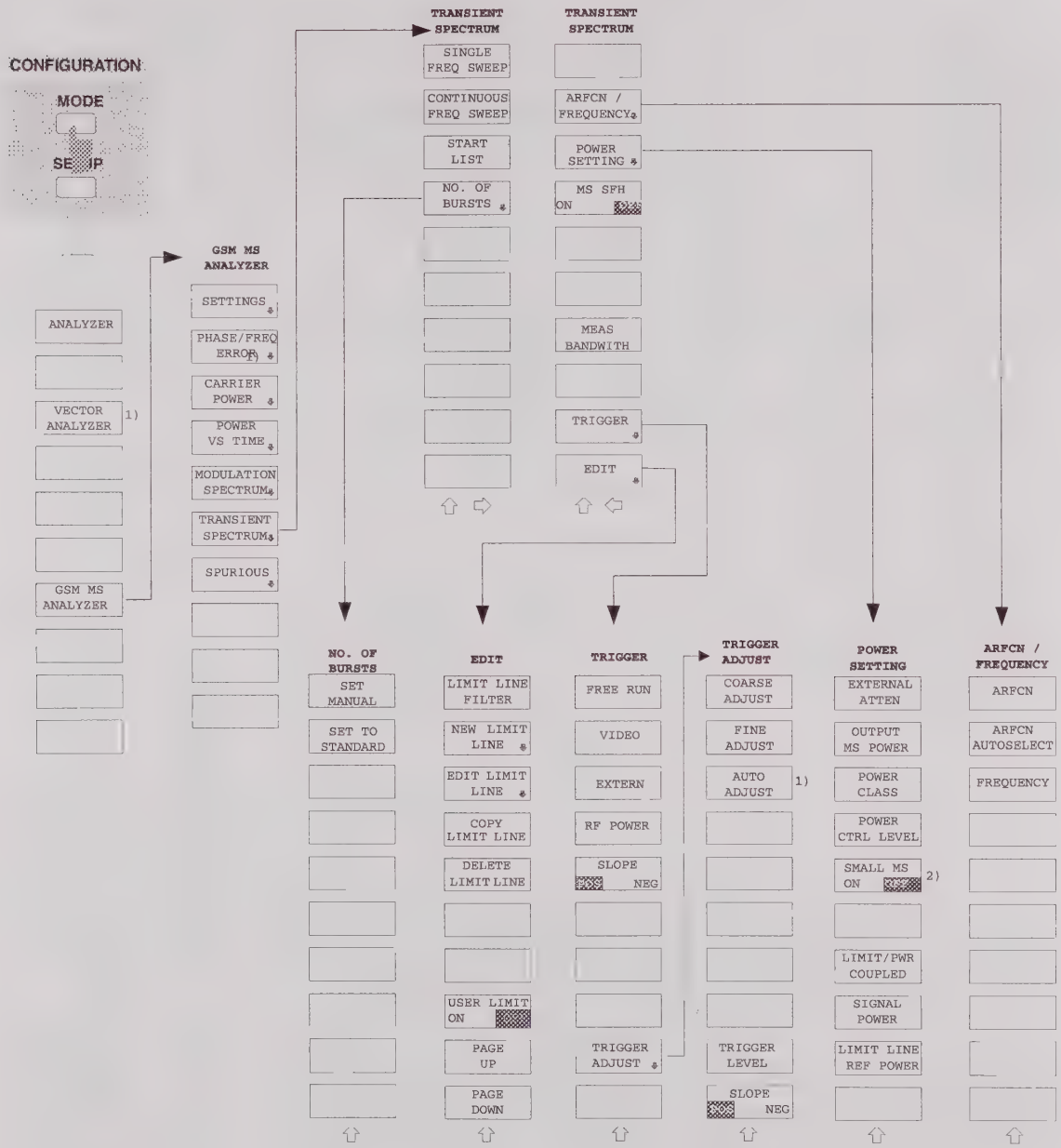


1) only with Option FSE-B7 (Vector Analyzer) installed

2) The "Small MS ON/OFF" softkey is available only for R-GSM (and DCS-II+); it serves for controlling the exceptions from the standard specifications that are permitted for "Small MS" (presently for SPU Tx limit only).

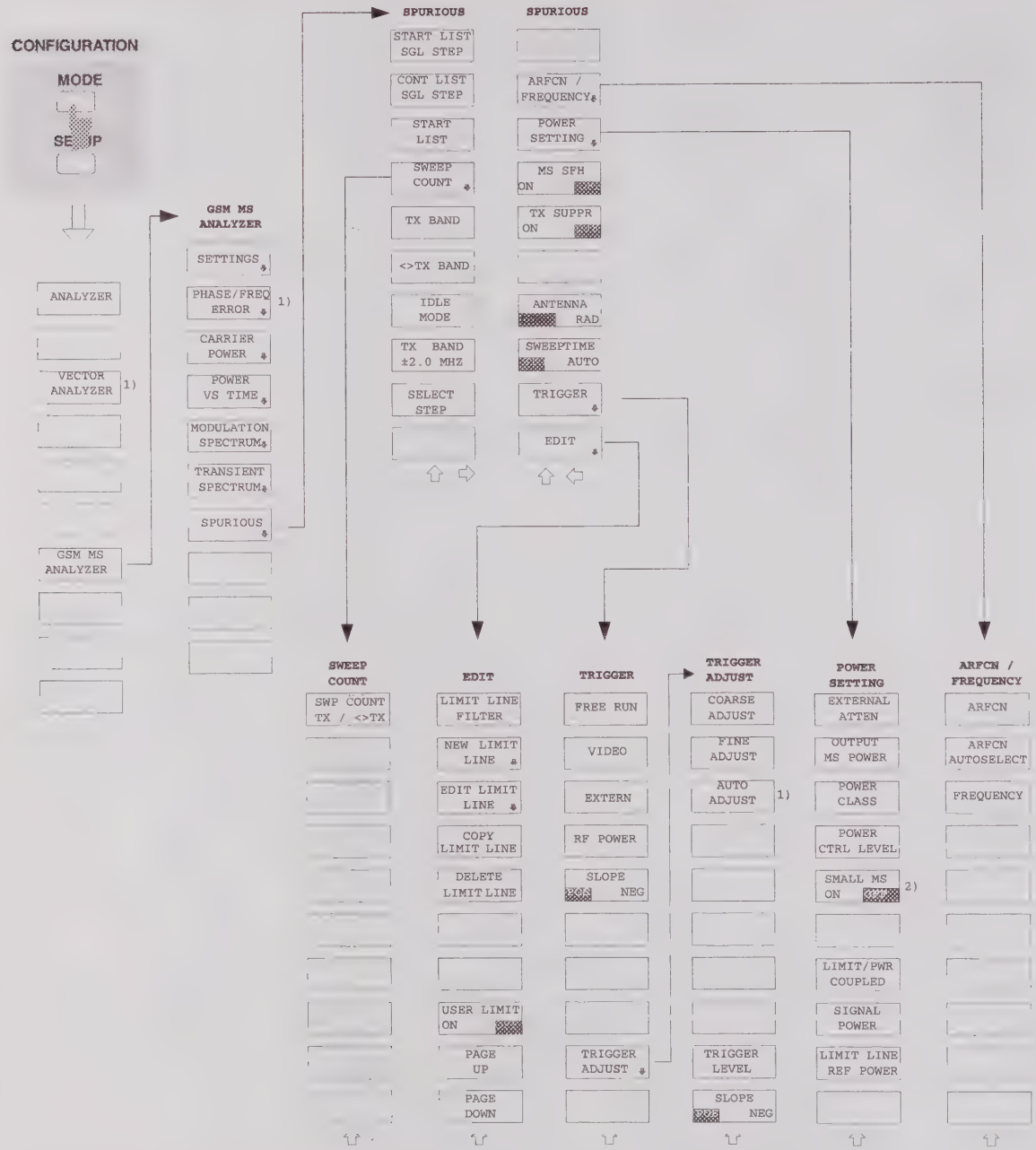


1) only with Option FSE-B7 (Vector Analyzer) installed
2) The "Small MS ON/OFF" softkey is available only for R-GSM (and DCS-II+); it serves for controlling the exceptions from the standard specifications that are permitted for "Small MS" (presently for SPU Tx limit only).
3) not for GSM900 phase
4) not for PCS1900, in that case just a softkey RX BAND



1) only with Option FSE-B7 (Vector Analyzer) installed

2) The "Small MS ON/OFF" softkey is available only for R-GSM (and DCS-II+); it serves for controlling the exceptions from the standard specifications that are permitted for "Small MS" (presently for SPU Tx limit only).



1) only with Option FSE-B7 (Vector Analyzer) installed

2) The "Small MS ON/OFF" softkey is available only for R-GSM (and DCS-II+); it serves for controlling the exceptions from the standard specifications that are permitted for "Small MS" (presently for SPU Tx limit only).

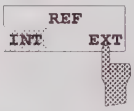
3.3 Selection of Default Settings

Setting reference frequency

Press SETUP key.

Press *EXT. REF FREQUENCY* ① key and enter the frequency according to the frequency standard.

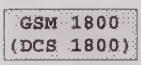
Set softkey *REF INT/EXT* to *EXT* (external reference frequency).

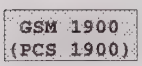


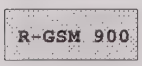
The *SETTINGS* softkey calls the submenu for presetting the test parameters. The associated secondary menu permits to select the transmission system. The parameters to be varied frequently such as channel, power, midamble, etc. are to be found in the main part of the submenu for ease of access.

3.3.1 Selection of the Standard

Menu: *CONFIGURATION MODE - GSM MS ANALYZER - SETTINGS*

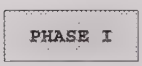


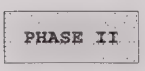


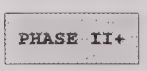


Softkeys *P-GSM 900, E-GSM 900, GSM 1800* (*DCS 1800), GSM 1900* (*PCS 1900)* and *R-GSM 900* set the standard to be used for the measurement. The 5 softkeys are selection switches, ie when one is active, the others are automatically de-activated. If a standard is selected, the FSE/FSIQ uses the standard-specific settings and limit values for the measurement.

With the standard P-GSM 900/phase 1 the measurement is made according to GSM11.10, with DCS 1800/phase 1 to the ETSI standard ETS 300,020-3 (GSM 11.10-DCS), with P-GSM 900/phase 2 and DCS 1800/phase 2 as well as E-GSM 900 to the ETSI standard ETS 300,607-1 (GSM 11.10-1) and with PCS 1900 to the American standard J-STD-007 Air Interface. The standards GSM 05.05 and GSM 11.10-1 are also the basis for the measurement of phase II+ (with R-GSM).







The *PHASE I/II/II+* softkeys changes the sequence of measurements and the associated limit values according to the selected phase of the standard .

With some standards, the softkeys are not available (PCS 1900) or partly available because no phases or not all of them are defined.

3.3.2 Consideration of the External Attenuation

For measurements at the RF interface, RF cables, attenuator pads, power splitters, directional couplers or other devices are used to match the level of the RF signal or connect further test equipment. The attenuation from the RF interface of the transmitter to the RF input of the FSE/FSIQ can be corrected by a constant attenuation factor.
Settings which produce a level >27 dBm at the input of the FSE/FSIQ – taking into account the other settings -are generally not possible with the *EXTERNAL ATTEN* softkey.

To prevent the occurrence of an overload, a warning is displayed for those settings which would lead to the threshold level being exceeded (*POWER CLASS, EXTERNAL ATTEN, OUTPUT MS POWER, POWER CTRL LEVEL)* and the set value is ignored.

Menu: *CONFIGURATION MODE - GSM MS ANALYZER - SETTINGS*

The softkey *EXTERNAL ATTEN* opens a window for entering the attenuation used externally. This value is used to correct the level displayed. All measured levels and the inscription of the Y-axis of the measurement diagram are shifted by the selected correction value. The effect of the softkey is identical with the input of a level offset (*REF LEVEL OFFSET*) using the *REF* key in the analyzer mode.

Default setting is 20 dB attenuation. This value is to be corrected when another attenuation is used.

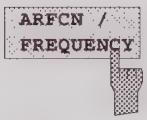
Note: *For measurements in the **RX band** with modulation spectrum, the attenuation entered with EXTERNAL ATTEN is irrelevant. In this case the RX band gain softkey has basically the same effect.*
The FSE/FSIQ switches to an internal attenuation of 0 dB at the beginning of the measurement and, at the end of it, to the value set prior to starting the measurement. The carrier is to be sufficiently suppressed by appropriate measures (eg by means of a bandstop filter). If an external attenuation is used for a measurement in the RX band, it can be taken into account via RX BAND GAIN (negative value of RX BAND GAIN = attenuation in the RX BAND).
If the DUT to be measured has a very high output power, an FSE/FSIQ-internal attenuation (RF ATT) should without fail be set. The 10 dB steps may be excessive in some cases since the noise level increases by approx. 10 dB when adding an attenuation of 10 dB.
If a high dynamic range is required, it is expedient to use an external attenuation (which can be varied in steps smaller than 10 dB in most cases) in order to remedy to the large steps of the RF ATT.
For each dB step of the external attenuator, the RF ATT is increased by 10 dB approx. one dB later. This extends the dynamic range.

3.3.3 Setting the Transmission Channel

The operating frequency (ie the carrier frequency) is entered via the ARFCN (Absolute Radio Frequency Channel Number: the transmission band is divided into channels of 200 kHz each of which is identified by means of a standard-dependent number) or directly as a frequency value.
In the case of ARFCN entry, the frequency is limited to the standard range of the transmission band.
Direct entry of the operating frequency, on the other hand, allows values from 1.8 MHz to $f_{analyzer\ max}$-1.8 MHz; beyond the transmission band, the band definitions Tx, NTx, Rx make no sense, so only measurements related to the carrier frequency are possible: this includes all measurements performed directly on the carrier - PFE, PVT, CPW/CPI – as well as the relative measurements TRA and MOD-ARFCN ±1.8MHz. If the frequency entered is within the Tx band, the described limitations need not be taken into account.

The search range of the automatic ARFCN determination covers the whole Tx band. Due to the features of the marker-to-peak search, an ARFCN is always determined even if no carrier signal is active in the Tx band.

Menu: *CONFIGURATION MODE - GSM MS ANALYZER - SETTINGS*



The *ARFCN / FREQUENCY* (Absolute Radio Frequency Channel Number) softkey calls a submenu which offers three possibilities for setting the transmission frequency of the MS:

Setting the ARFCN [as channel number]

Automatic searching for the carrier frequency in the frequency band defined by the standard and automatic setting of the found channel or frequency.

Entering a frequency in Hz, kHz ...

On calling the menu *ARFCN / FREQUENCY,* the input field for the ARFCN generally opens.

With the *FREQUENCY* softkey it is possible to set the frequency freely, ie without limitation imposed by the standard-defined transmission band.

Three cases are distinguished:

a) the entered frequency is exactly on the ARFCN

b) the entered frequency is in the TX band but off a permissible ARFCN

c) the entered frequency is out of the TX band.

The displayed channel number is rounded if the entered frequency does not exactly correspond to an ARFCN.

On entering the menu and quitting the input field, the colour of the softkey indicates the selection (only with a colour display):

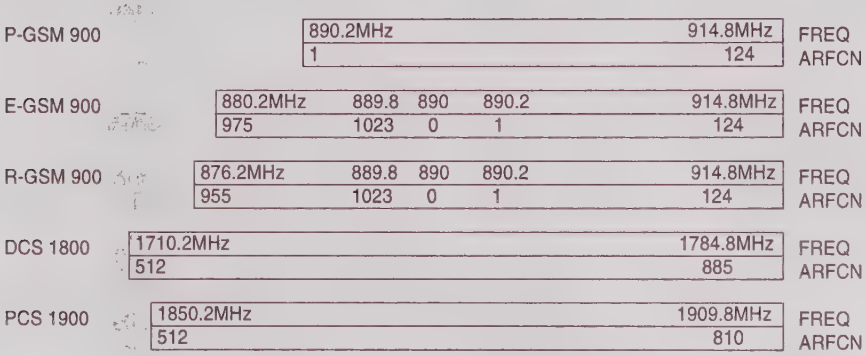
a) ARFCN is green, *FREQUENCY* is grey

b) ARFCN is green, *FREQUENCY* is green

c) *ARFCN* is grey, *FREQUENCY* is green

The center frequencies are assigned to the channels as follows:

P-GSM 900	Fl(n) = 890 + 0.2*n	1 ≤ n ≤ 124	Fu(n) = Fl(n) + 45
E-GSM 900	Fl(n) = 890 + 0.2*n	0 ≤ n ≤ 124	Fu(n) = Fl(n) + 45
	Fl(n) = 890 + 0.2*(n-1024)	975 ≤ n ≤ 1 023	
R-GSM 900	Fl(n) = 890 + 0.2*n	0 ≤ n ≤ 124	Fu(n) = Fl(n) + 45
	Fl(n) = 890 + 0.2*(n-1024)	955 ≤ n ≤ 1023	
DCS 1 800	Fl(n) = 1710.2 + 0.2*(n-512)	512 ≤ n ≤ 885	Fu(n) = Fl(n) + 95
PCS 1 900	Fl(n) = 1850.2 + .2*(n-512)	512 ≤ n ≤ 810	Fu(n) = Fl(n) + 80



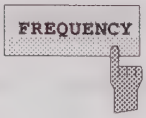
Pressing the *ARFCN* softkey opens an input field in which the desired channel number can be entered.

In the FSE/FSIQ, the center frequency is then set to the frequency specified in the standard to correspond to the selected channel.

If a frequency which lies outside the transmission channel as given by the standard has been selected by means of the *FREQUENCY* softkey, an empty input field is displayed with a message (ARFCN not defined) instead of the channel number.

The *ARFCN AUTOSELECT* softkey automatically searches for the transmission channel and sets the center frequency to the channel of the carrier found. The search is performed in a sweep over the entire frequency range of the transmission band ((TX BAND). The maximum level occurring in the transmission channel is searched for with the aid of the marker. The marker frequency is assigned to the respective channel.

The function is performed once after it has been called up.
Frequency hopping is ignored during automatic search (AUTO ADJUST), ie the entire TX band is examined once. The SFH of the MS should therefore be switched off.



The FREQUENCY softkey opens an input field in which the desired MS frequency can be entered without link to the channel spacing.

The frequency unit (Hz, kHz, MHz) is selected in the DATA ENTRY field with the grey keys next to the numeric keypad.

It is also possible to enter frequencies which are out of the range specified in the selected standard.

If the entered frequency is within the TX band of the selected standard, the channel which is next to the selected frequency (arithmetic rounding) is displayed after pressing the ARFCN softkey.

Permissible frequencies are:
1.8 MHz ≤ frequency≤ (maximum instrument frequency – 1.8 MHz).

3.3.4 Setting the Transmit Power of the MS under Test

The mobile's nominal transmit power is to be reported to the FSE/FSIQ so that it can select correct default settings such as input attenuation, reference level and limit values. The mobile's transmit power is determined by its power class and the power control level. The power class defines the maximum possible output power of the base station, whereas the power control level determines the actual output power.

The information on the power set in this menu enables the FSE/FSIQ to make optimal settings for Ref Lvl and attenuation in the active measurement. The formulae for determining the settings are explained in the measurement chapters.

The limit values for a measurement, for instance, are selected with reference to the power level. However, the coupling of limit values and the power control level may also be undone, which allows limit values of any power control level to be used for measurements with freely selectable power.

To protect the FSE/FSIQ, the settings made in the POWER menu are automatically checked to make sure that the input level at the FSE/FSIQ does not exceed 27 dBm.
(MS output power – attenuation ≤ 27 dBm).

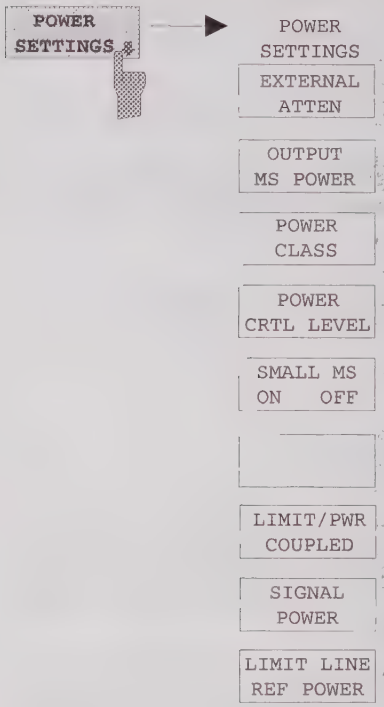
To prevent the occurrence of an overload, a warning is displayed for those settings which would lead to the threshold level being exceeded (*POWER CLASS, EXTERNAL ATTEN, OUTPUT MS POWER, POWER CTRL LEVEL)* and the set value is ignored.

Since the power measurement is subjected to very stringent accuracy requirements, the analyzer should not be overdriven.
To prevent this the unit monitors the signal level determined in the preview to establish if the RefLevel is exceeded by more than 1 dB. If this is the case, a warning is output.

In addition to the output power of the DUT the external attenuation or an external amplifier has to be taken into account.
An attenuation value is usually expected. For measurements in the Rx band an amplifier is more suitable so there are 2 possible values which are exclusively used for the same operation.

- External attenuation (negative value: gain) for all measurements outside the Rx band;
- Rx gain (gain) for all Rx-band measurements (negative value: attenuation).

Menu: *CONFIGURATION MODE - GSM MS ANALYZER - SETTINGS*



The *POWER SETTINGS* softkey opens a submenu, in which the following settings can be made:

EXTERNAL ATTEN	Entering external attenuation
OUTPUT MS POWER	Setting the power expected at the MS antenna
POWER CLASS	Setting the MS power class
POWER CTRL LEVEL	Setting the power control level
SMALL MS	Selecting small MS or normal MS (has an effect on limit values of spurious measurement only)
SIGNAL POWER	Setting output power of the mobile without affecting the limit values while *LIMIT/PWR COUPLED* is inactive
LIMIT REF POWER	Setting the power with reference to the limit values

The softkeys *OUTPUT MS POWER, POWER CLASS* and *POWER CTRL LEVEL* are available only if *LIMIT/PWR COUPLED* is active.

The softkeys *SIGNAL POWER* and *LIMIT REF POWER* are available only if *LIMIT/PWR COUPLED* is inactive.

The softkey *LIMIT/PWR COUPLED* is for switching between "Coupling active" and "Coupling inactive".

***LIMIT/ PWR COUPLED* active:**

If the coupling between the limit values used by the FSE/FSIQ and the selected MS power is activated, the expected MS output power can be set on the FSE/FSIQ either via *OUTPUT MS POWER* [in dBm (with accuracy 0.1 dBm)], or via *POWER CLASS* and *POWER CTRL LEVEL* [with the relevant numbers of the power class and the power control levels].

The settings on the FSE (selection of limit values, setting of Ref Lvl, attenuation) are made in accordance with standards corresponding to the selected MS transmitter power.

***LIMIT/ PWR COUPLED* inactive:**

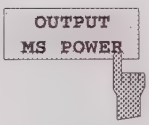
If the coupling between the limit values used by the FSE/FSIQ and the selected MS power is deactivated, the expected MS output power can be set on the FSE/FSIQ via *SIGNAL POWER* [in dBm (with accuracy 0.1 dBm)].

The settings on the FSE (Ref Lvl, attenuation) are made corresponding to the selected *SIGNAL POWER*. The selected external attenuation is taken into account.

The limit values selected by the FSE/FSIQ are not coupled to the power setting. With the softkey *LIMIT REF POWER*, the user can freely select the power for which the limit values defined by the standard are set.

In decoupled operation, it is therefore possible to make measurements on or in an MS (eg ahead of the output amplifier) and select limit values which correspond to a nominal power much higher than that actually output.

POWER CLASS and *POWER CTRL LEVEL* are coupled. The power class defines the maximum power of the mobile, which in turn determines the minimum power control level (high power -> low power control level). If a power control level is selected that is not possible for the set power class, the message "Limit reached" will be displayed in the entry window and the entered value ignored.



The *OUTPUT MS POWER* softkey activates the entering of the expected MS power in dBm.
The value range is limited as prescribed by the selected standard.

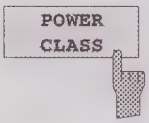
If the value entered does not correspond to any power class (and power control level) contained in the selected standard, the closest value permitted by the standard will be selected and this correction indicated in an extra window.

If power class and power control level values are adjusted in this way, the power control level will be modified within the limits of the currently set power class. If this is no longer possible because the output power is changed further, the power class will be changed as well. This is indicated by the message "Power Class Changed".

Example PGSM II:

Entering 37 dBm	power class =3, Pwr Ctrl Level=3
Entering 39 dBm	power class =2, Pwr Ctrl Level=2
Entering 37 dBm	power class =2, Pwr Ctrl Level=3

Alternatively, power class and power control level may be set using the softkeys described in the following, eg in case power is not known.



The *POWER CLASS* softkey activates the selection of the MS power class.

If a new power class is set, the value displayed under POWER CTRL LEVEL will be reset to a value matching the maximum permissible power.
This defines the maximum output power for the mobile station.

The standards stipulate five different classes, yet they are not all available due to the limitations arising from the selected phase and standard.
The power steps in the range defined by *POWER CLASS* are set via POWER CTRL LEVEL.

The following power classes defined by the standards are available:

Table 3-1 Power classes

Power class	Power P-GSM 900 phase I	E/P/R-GSM900 phase II	DCS1800 phase I	DCS1800 phase II	PCS1900
1	43 dBm	--	30 dBm	30 dBm	30 dBm
2	39 dBm	39 dBm	24 dBm	24 dBm	24 dBm
3	37 dBm	37 dBm	--	36 dBm	33 dBm
4	33 dBm	33 dBm	--	--	--
5	29 dBm	29 dBm	--	--	--

The *PWR CTRL LEVEL* softkey defines the dynamic power control level and thus the current power of the mobile. The standards stipulate 24 different power control levels, yet they are not all available due to the limitations arising from the selected phase and standard. The softkey opens a window, in which the output level is selected by entering one of the numbers 0 to 31.

The following power control level values may be selected, depending on the standard used:

Table 3-2 Power control level

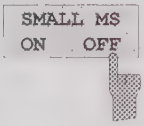
Power control level	Power				
	GSM900 phase I	GSM900 phase II/II+	DCS1800 phase I	DCS1800 phase II/II+	PCS1900
29	--	--	--	36 dBm	reserved
30	--	--	--	34 dBm	33 dBm
31	--	--	--	32 dBm	32 dBm
0	43 dBm	39 dBm	30 dBm	30 dBm	30 dBm
1	41 dBm	39 dBm	28 dBm	28 dBm	28 dBm
2	39 dBm	39 dBm	26 dBm	26 dBm	26 dBm
3	37 dBm	37 dBm	24 dBm	24 dBm	24 dBm
4	35 dBm	35 dBm	22 dBm	22 dBm	22 dBm
5	33 dBm	33 dBm	20 dBm	20 dBm	20 dBm
6	31 dBm	31 dBm	18 dBm	18 dBm	18 dBm
7	29 dBm	29 dBm	16 dBm	16 dBm	16 dBm
8	27 dBm	27 dBm	14 dBm	14 dBm	14 dBm
9	25 dBm	25 dBm	12 dBm	12 dBm	12 dBm
10	23 dBm	23 dBm	10 dBm	10 dBm	10 dBm
11	21 dBm	21 dBm	8 dBm	8 dBm	8 dBm
12	19 dBm	19 dBm	6 dBm	6 dBm	6 dBm
13	17 dBm	17 dBm	4 dBm	4 dBm	4 dBm
14	15 dBm	15 dBm	--	2 dBm	2 dBm
15	13 dBm	13 dBm	--	0 dBm	0 dBm
16	--	11 dBm	--	0 dBm	reserved
17	--	9 dBm	--	0 dBm	reserved
18	--	7 dBm	--	0 dBm	reserved
19	--	5 dBm	--	0 dBm	reserved
20..28	--	--	--	0 dBm	reserved
20..31	--	5 dBm	--	--	--

Power control level and power class are coupled, as shown in the above table.
The maximum selectable power control level depends on the power class of the mobile.

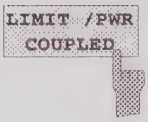
Example:

P_GSM900
Power class = 2 (≡ 39 dBm)
PWR CTRL Level = 2 to 15

If a power control level is selected that is not possible for the set power class, the message "Limit reached" will be displayed in the entry window and the entered value ignored.



The *SMALL MS ON/OFF* softkey serves for determining whether the limit values are to be selected for a normal MS (*OFF*) or a SMALL MS (*ON*).
In the K10 option, the limit values of these types of mobiles are different for spurious measurements only, so this softkey only affects this type of measurement.
This softkey is available for the standard R-GSM of phase II+ only.
A small MS is defined in standard 05.05 as a mobile of power class 4 or 5 which cannot be permanently installed in a vehicle.

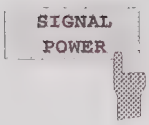


The *LIMIT /PWR COUPLED* softkey determines whether the limit values are selected automatically (as a function of *POWER CLASS* and *PWR CTRL LEVEL*) or manually with the *LIMIT REF POWER* softkey.

If the coupling is activated, only those softkeys of the menu are available that are located above this softkey.

If the coupling is deactivated, only those softkeys of the menu are available that are located below this softkey, plus *EXTERNAL ATTEN*.

If the *LIMIT /PWR COUPLED* softkey is switched off, absolute limits and base lines are not taken into account.

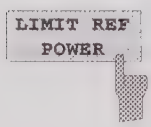


The *SIGNAL POWER* softkey sets the FSE/FSIQ directly to the signal level expected at the FSE/FSIQ input. The selected external attenuation is taken into account.

RF ATT and *REF LEVEL* are set optimally for the active measurement depending on the settings made under this softkey. The formulae for determining the settings are explained in the measurement chapters.

Example: The output power of the MS is 33 dBm, the external attenuation 20 dB.
SIGNAL POWER = 33 dBm is entered. The FSE/FSIQ is set for an input level of 13 dBm.

This softkey is available only if *LIMIT/PWR COUPLED* is inactive.



With the *LIMIT REF POWER* softkey , the MS power is defined to which the limit values selected on the FSE/FSIQ are referred.
The setting made with this softkey is relevant only for the measurements TRANSIENT SPECTRUM and MODULATION SPECTRUM, since limit values are checked depending on the transmit power just in these measurements.

The entry is made in dBm.
This softkey is available only if *LIMIT/PWR COUPLED* is inactive.

3.3.5 Setting the Limit Margin (limit tolerance range)

Menu: *CONFIGURATION MODE - GSM MS ANALYZER - SETTINGS*

The *LIMIT MARGIN* softkey activates the entry of a limit tolerance range for the measurements SPURIOUS, TRANSIENT SPECTRUM and MODULATION SPECTRUM of the MS test software FSE-K10.

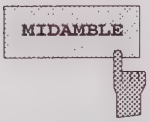
Upon actuating this softkey, an input field is opened in which the desired tolerance range can be given in dB.

If the value 3 dB is entered here, this means that the tolerance range lies between the limit minus 3 dB and the limit itself (with an upper limit).

If a limit is in this tolerance range, this is indicated by MARGIN (instead of PASSED, FAILED) in the result display for the corresponding measurement.

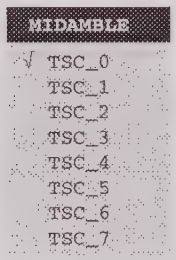
3.3.6 Selection of the Midamble

Menu: *CONFIGURATION MODE - GSM MS ANALYZER - SETTINGS*



The *MIDAMBLE* softkey opens a table for selecting the midamble used by the mobile. The midamble is required to determine the time reference only if option Vector Signal Analysis FSE-B7 is installed. If the option is not installed, the softkey is inactive.

The softkey opens a selection table in which all available midambles are offered for selection.



TSC_0 to TSC_7 (Training Sequence Code) represent the training sequences for the normal burst.

The desired midamble is selected by means of the cursor keys or the rollkey and switched on using one of the unit keys. The selected midamble is marked by a tick.

3.3.7 Setting the Trigger

Mobile measurements require an appropriate trigger so that the time reference between the TDMA burst and the measurement proper can be established. For this purpose, an external trigger signal is usually required, which can be derived from the DUT. Some measurements can also be performed in the *FREE RUN* mode.

Internal RF POWER triggering may only be used if the level after internal attenuation is ≥20 dBm and if the measurement is made directly on the carrier. For some measurements, the RF POWER trigger does not have the required broadband characteristics (for modulation spectrum in TX and RX band spurious emissions) or is not sensitive enough (for carrier power) and may therefore be used to a limited extent only, or not at all. For this reason, spurious cannot be measured with this trigger, while spectrum due to modulation can be measured for ARFCN 1.8 MHz only and average carrier power to a limited extent.

If an external trigger is used as the FRAME trigger (eg of the CMD), the values obtained from the measurement of the spectrum due to modulation are falsified. The cause for this is the IDLE burst which appears every 26th frame trigger pulse (the MS is IDLE every 26th frame). This is a problem especially with the measurement of the modulation spectrum during which invalid values are averaged (ie measured values recorded during the IDLE burst). If the 26 MULTIFRAME of the CMD is used as external trigger, the modulation spectrum is measured correctly. It should be noted, however, that the measurement time is considerably prolonged (the period of the 26 MULTIFRAME is 120 ms). An additional diode detector is used to remedy this. It rectifies the RF and outputs a trigger pulse only if the power is actually present (see also Application Note 1MA01_0D and 1MA06_0D).

The following table shows the possible trigger modes for the different measurements:

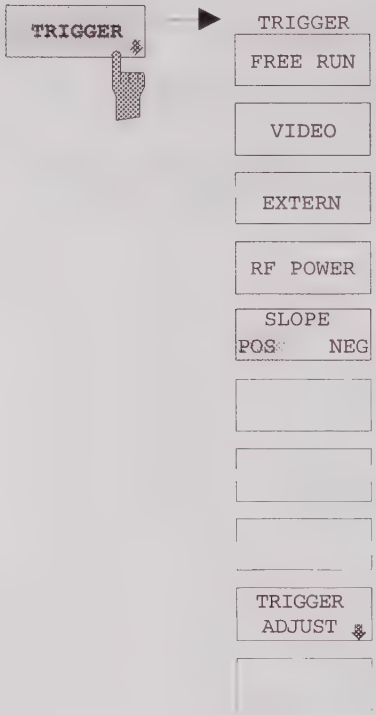
Table 3-3 Possible trigger modes for the different measurements

Measurement	**Trigger**	**Midamble synchronization (with Vector Signal Analysis FSE-B7)**
Carrier power	External / video/ RF power*	√ (switchable)
Power vs. time	External / video / RF power*	√ (switchable)
Phase / frequency error	External / video / RF power* / Free Run	√ (obligatory)
Spectrum due to modulation	External / RF POWER*	--
Spectrum due to switching	External / RF POWER* / Free Run	--
Spurious emissions	External / Free Run	--

*) RF power in frequency range ARFCN ±1.8 MHz only, provided a minimum of -20 dBm following the internal attenuator. The formulae for determining the settings are explained in the measurement chapters.

For measurements of the phase/frequency error, the midamble contained in the burst is used as time reference for triggering. For measurement of the carrier power and the power vs time, the default setting of the time reference is the mode synchronization to the midamble (SYNC TO MIDAMBLE ON) provided the option Vector Signal Analysis FSE-B7 has been installed.

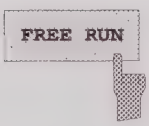
Menu: *CONFIGURATION MODE - GSM MS ANALYZER - SETTINGS*



The *TRIGGER* softkey calls the submenu for the selection of the trigger source. EXTERNal trigger is the default setting. It is suitable for all measurements.

A different trigger source for the measurements is only possible if shown in table 3-3.

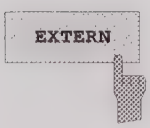
For general information on the trigger functions, see instrument manual.



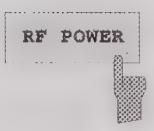
The *FREE RUN* softkey activates the free-run mode without trigger.

The *VIDEO* softkey activates the video voltage as trigger source.

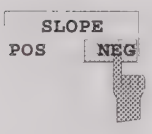
Upon activating the video trigger, a window is opened in which a trigger level can be entered.



The *EXTERN* softkey activates an external trigger source.
Upon activating the external trigger, a window is opened in which a trigger level can be entered.



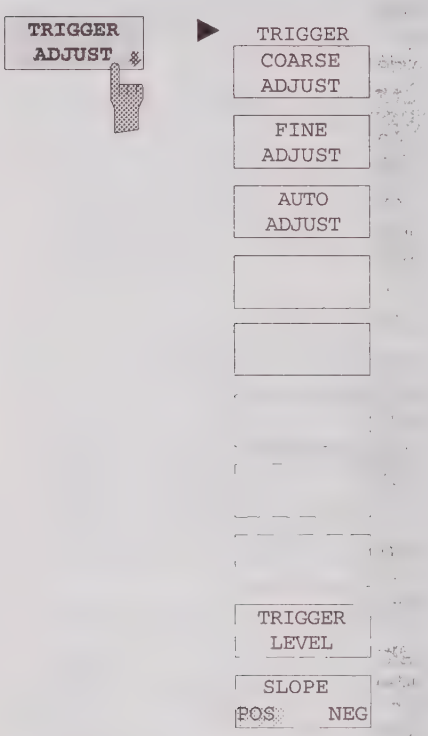
The *RF POWER* softkey activates signals outside the measurement channel as trigger source.



The *SLOPE POS/NEG* softkey selects the trigger slope.

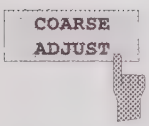
3.3.7.1 Trigger Adjustment

Menu: *CONFIGURATION MODE - GSM MS ANALYZER - SETTINGS - TRIGGER*



The *TRIGGER ADJUST* softkey calls a submenu in which the trigger can be adjusted.

When the submenu is called, *COARSE ADJUST* is active. The FSE/FSIQ displays the burst with a sweep time of 5 ms in the time domain.



The *COARSE ADJUST* and *FINE ADJUST* softkeys activate manual trigger adjustment.

If an external trigger is used, trigger delay is to be set such that the rising burst slope is located at the center of the screen. The –20 dB point is marked by a horizontal display line. The ⇑ and ⇓ keys shift the burst each time by one scaling (= 50 µs) to the right or left. Using the rotary knob, the burst is shifted by 1/10 of the scaling (= 5 µs) at each detent position.

Fine adjustment of the trigger is then to be performed and the rising burst slope once again centered in the screen by means of *FINE ADJUST*. The burst slope is displayed with a sweep time of 100 µs. The ⇑ and ⇓ keys shift the burst each time by half a scaling (= 5 µs) to the right or left. Using the rotary knob, the burst is shifted by 1/20 of the scaling (= 0.5 µs) at each detent position.

The trigger is to be set such that the burst is at the center vertical line of the display at a roll-off of around 20 dB. In this way, the reference for trigger measurements is provided.

The reference for the internal trigger (video trigger, RF power trigger) is set in the same way as for the external trigger.
When the menu is quit, FSE/FSIQ stores the trigger mode and uses it for the measurements.

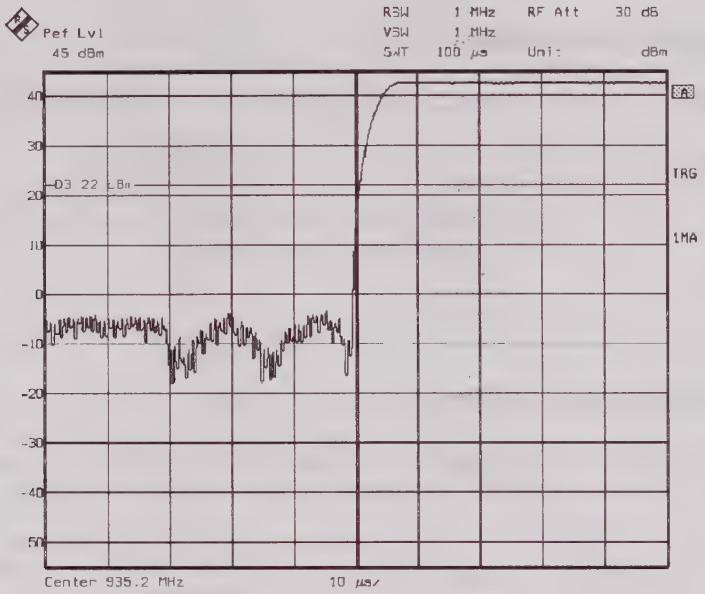


Fig. 3-1 Correct trigger adjustment in FINE ADJUST mode

Caution: *Manual adjustment to the –20 dB point of the trigger slope can only be an approximation to the correct time reference as the accurate reference to the midamble is not available. The automatic adjustment delivers the correct time reference to the midamble (depending on the burst edge slope the -20 dB point can be offset by up to approx. 7 µs from the screen center).*

AUTO ADJUST

The *AUTO ADJUST* softkey performs an automatic trigger adjustment of the midamble with reference to the bit transition 13/14 in the vector signal analysis mode.

Generally, trigger adjustment by means of *AUTO ADJUST* should be given preference over manual trigger adjustment.

The *AUTO ADJUST* is available only if Option FES-B7 is installed in the FSE.

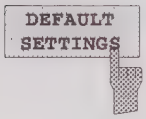
TRIGGER LEVEL

The *TRIGGER LEVEL* softkey is for entering trigger levels for trigger modes *VIDEO* and *EXTERNal* for viewing the selected burst.
This softkey is not available for other trigger modes.

3.3.8 Setting the Defaults

The default settings can be restored using the *DEFAULT SETTINGS* softkeys.

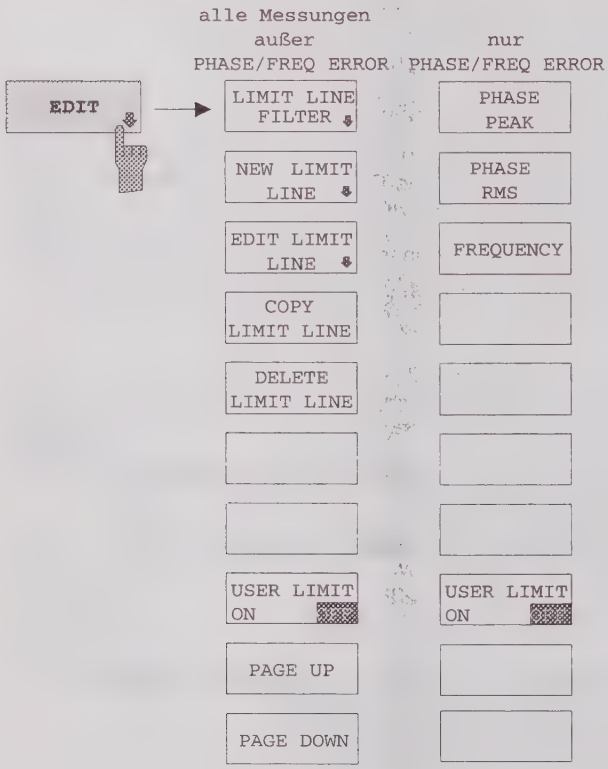
Menu: *CONFIGURATION MODE - GSM MS ANALYZER - SETTINGS*



The *DEFAULT SETTINGS* softkey resets the settings of FSE-K10 to the default values (see chapter 2.5).

3.3.9 Selection and Editing of Limit Lines

Menu: *CONFIGURATION MODE - GSM MS ANALYZER - CARRIER POWER / POWER VS TIME / MODULATION SPECTRUM / TRANSIENT SPECTRUM / SPURIOUS*



The EDIT softkey calls a submenu in which user-specific limit lines can be defined and activated.

The limit lines are edited via the limit line editor (a function of the basic unit).

For the measurement of phase and frequency error, only the values for the phase error and frequency error limit value are entered instead of limit lines. Separate softkeys are available for this purpose.

All limit lines of the GSM software are integrated and available on enabling the option. The names of the lines are displayed on the line.

To edit the existing limit lines, they have to be downloaded into the instrument from the CD-ROM supplied with option FSE-K10 (see CD-ROM leaflet).

Some characteristics of the limit lines of the GSM option cannot be modified manually. These are the exceptions and the clipping lines or sockets (... whichever is the highest ...) defined in the standards.

These special characteristics are only available in the GSM software.

The screen center is assigned to the time 0 for limit lines in the time domain. To define limits on the left of the screen center, negative time values have to be entered.

If the user has defined slant limit lines, these are converted into steps in the list mode for the measurements Spurious, Spurious Sgl Step, Modulation and Transient, as explained in the following diagram:

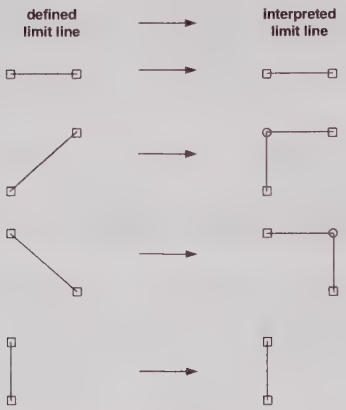
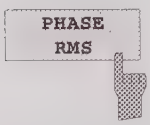


Fig. 3-2 Interpretation of user-defined limit lines

The *PHASE PEAK* softkey can be only accessed from the menu for the measurement of phase and frequency error.

It opens a window in which the limit value for the maximum permissible phase error can be entered in degrees.

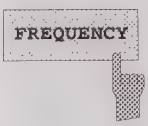
The value thus entered is displayed in the evaluation table for the measurement of phase and frequency error in the LIMIT column.



The *PHASE RMS* softkey can be only accessed from the menu for the measurement of phase and frequency error.

It opens a window in which the limit value for the permissible RMS phase error (determined over the 147 usable symbols) can be entered in degrees.

The value thus entered is displayed in the evaluation table for the measurement of phase and frequency error in the LIMIT column.



The *FREQUENCY* softkey can be only accessed from the menu for the measurement of phase and frequency error.

It opens a window in which the limit value for the permissible frequency error (determined over the 147 usable symbols) can be entered in ppm.

The value thus entered is displayed in the evaluation table for the measurement of phase and frequency error in the LIMIT column.

The *LIMIT LINE FILTER* softkey permits to filter the limit lines indicated in the table so that only those with the required characteristics are displayed.

For this purpose, the characters * (as a substitute for any characters that follow) and ? (as a substitute for one character that follows) may be used.

Example:

The following files exist:

Abc	Xyc	Abxydz
Abd	Xyd	Abxyda

When using filter AB*, the following files are displayed:

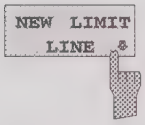
Abc	Abxydz
Abd	Abxyda

When using filter AB?, the following files are displayed:

Abc

Abd

Consecutive and several ? are permissible in a term.

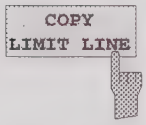


The *NEW LIMIT LINE* softkey calls a submenu in which a new limit line can be defined.

For further information, see operating manual on FSE or FSIQ.

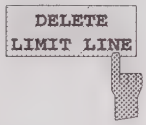
The *EDIT LIMIT LINE* softkey calls a submenu in which an existing limit line can be modified.

For further information, see operating manual on FSE or FSIQ.



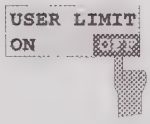
The *COPY LIMIT LINE* softkey permits to copy an existing limit line in a new file.

For further information, see operating manual on FSE or FSIQ.



The *DELETE LINE FILTER* softkey permits to delete an existing limit line.

For further information, see operating manual on FSE or FSIQ.



The *USER LIMIT ON OFF* softkey permits to activate or de-activate a user-defined marked limit line associated with the current measurement. The standard setting for this option is *USER LIMIT OFF.*

If *USER LIMIT* is switched to *OFF*, the software remembers the limit lines selected by the user. It is thus possible to change between standard and user-defined limit lines without having to mark again the limit lines every time.

The *PAGE UP* and *PAGE DOWN* softkeys permit to scroll page by page the limit lines available in the list if more than 20 of them are available.

3.3.10 Limit Values and Limit Lines

3.3.10.1 Types of Limit Values

For the measurements PFE and CPW, the limit values are predefined in discrete form, ie with numeric values for specific test points. For CPW these are, for example, the level tolerances between different test steps, for PFE the maximum permissible error for frequency and phase.

In contrast the limit values for the other measurements are given as range limit values: as ***limit lines***.

These lines stipulate a permissible maximum level (for PVT also minimum level) for a particular range (frequency or time domain). An error condition is given when this level is over- or underranged.

The indications for these lines can be either *relative* or *absolute* for the two axes independently of each other. The form of indication is specific for the measurement on hand.

Examples of absolute limit lines are for example in the SPU measurement. In this case, the frequency and also the level are explicitly given (eg: 1 GHz – 12.75 GHz / -30 dBm).

3.3.10.2 Calculation of Relative Limit Lines

The actual values for delay are determined with relative lines. For the frequency, the indications generally refer to the carrier frequency (TRA, MOD). The absolute level value is determined relative to a reference level which can be determined in a preview. Time indications (PVT) refer to the center of the midamble.

Examples of relative lines:

FSE-K10 TRA:	Offset	Level (30dBm)	Level (24dBm)	Level (<= 20 dBm)
(DCS-I)	400 KHz	-22 dBm	-23 dBm	-23 dBm
	600 KHz	-24 dBm	-26 dBm	-26 dBm
	1200 KHz	-24 dBm	-30 dBm	-32 dBm
	1800 KHz	-27 dBm	-33 dBm	-36 dBm

The offset indicates the relative spacing to the carrier frequency (symmetric line) but the level is defined as an absolute value. However, one of the three lines should be selected depending on the set power control stage (in accordance with the nominal output power) of the mobile. A premeasurement is not necessary since all level values are given at the beginning of the measurement.

3.3.10.3 Special Features with Relative Limit Lines

There are other special features and conditions which should be taken into account. In addition to the rules for the determination of the reference point and for the selection of the appropriate line,

- the base line and
- the tolerance zone (exceptions)

should be considered. The two terms are illustrated using an example.

The ***base line*** is the limitation of the line to a fixed minimum value (clipping). It is used only with limit lines of the 'upper' type (ie maximum level) in FSE-K10. The effect is such that a relative line is limited to this base value at the latest even if the calculation based on the actual reference level would yield lower limit values. The base line is used with PVT, TRA and MOD. With TRA, for example, the limitation is at a maximum S/N ratio of –36 dBm.

Tolerance zones are a speciality of modulation measurement. They indicate a region in which the predefined limit value is exceeded but where a certain number of overranges is tolerated. Particular care is necessary when dealing with a combination of base lines and tolerance zones.

The following cases are possible:
The different limit line variations are given from left to right. The texts in the different ranges specify the evaluation of the signal at this point provided the measured value is in the corresponding range.

The displayed relative limit line cuts the tolerance zone (represented as exception line) and the base line with respect to the reference level.

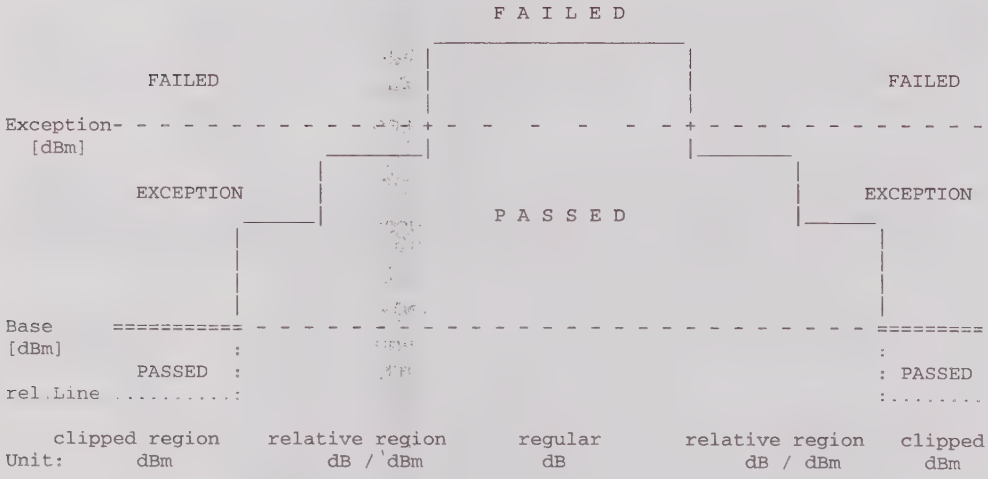


Fig. 3-3 Types of limit values

As explained in detail later, the level unit (dB or dBm) in the result table indicates the type of region in which the measured value lies.

3.3.10.4 Forms of Output

Visual - Trace

The single and continuous measurements graphically reproduce the signal shape and the measured signal is evaluated by means of displayed limit lines. A global evaluation (PASSED/MARGIN/FAILED) is performed by the system and the information is displayed on the screen with the name of the limit line.

Table

The result delivered by LIST measurements is in the form of a table listing the measured sections and test points. A global evaluation is indicated in the table head (PASSED/FAILED/ABORTED) and the test results are given in the table columns.

The global evaluation of the measurement is performed at the end of the single measurements. The indication 'ABORTED' means that the measurement has been aborted by the user and the individual results are thus not complete.
The table contents are explained in detail in the next section.

IEC/IEEE bus

The results of the individual measurement steps can be queried via IEC/IEEE bus. The syntax and semantics of the required commands are indicated in chapter 4 and in chapter 3 of the the user manual of the basic instrument.

3.3.10.5 Table Contents of the Different Measurements

a) General Structure

The tables have all the same structure:

Table head comprising:
- Title line
- Measurement indications

Table contents comprising:
- Title line with column information
- Measured values arranged in columns, with
  - [Indication of section - Summary] (optional)
  - Individual measured value (table-dependent)
  - :
  - Individual measured value (table-dependent)
  - [Indication of section - Summary] (optional)

Examples for the layout of the different tables are given in the section concerning the corresponding measurement.

b) Table Head

The table head is almost identical for all measurements.
The title line contains indications on

- Standard and phase
- Measurement
- Band

Indication is also given on whether it is a normal measurement (limit lines to standard) or a measurement with user-defined limit lines.

Then the indications on the relevant test parameters are given:

- Channel number (empty if the frequency is not in the standard region)
- Carrier frequency
- Nominal and actual signal level
- External attenuation (or Rx gain)
- Number of bursts
- Global status of the measurement { PASSED | FAILED | ABORTED }

With CPW, the selected measurement condition NORMAL or EXTREME as well as the trigger type – MIDAMBLE or TRIGGER - are given instead of the actual signal level.

c) Table Contents CPW

The following columns are available:

- Line number
- Power control level
- Power prescribed for this power control level by the standard
- Measured power
- Limit value of absolute power as specified in the standard
- Measured power difference to previously measured power control level
- Limit value range of power difference (with reference to previously measured control level) as specified in the standard
- Measurement status (passed, margin, failed)

No	PWR CTRL LVL	NORM PWR dBm	MEAS PWR dBm	LIMIT PWR min.. max dBm	MEAS DELTA dB	LIMIT DELTA min.. max dB	STATUS
xxx	xx	±xx.x	±xx.x	±xx.x.. ±xx.x	xx.x	±xx.x.. ±xx.x	PASSED

d) Table Contents CPI

- ARFCN Channel frequency number ('----' with frequencies outside of the Tx band)
- Status Evaluation of the single measurement (PASSED/FAILED)
- Frequency Carrier frequency (in Hz)
- CarrPwr Measured carrier power (dBm)
- Condition NORMAL/EXTREME
- Att/Gain External attenuation (dB)
- NofBursts Number of measurement cycles

e) Table Contents TRA

The results are output for all measurements relative to the carrier:

- Number optional, only available with status <> is not PASSED
- Frequency offset 400 / 600 / 1200 / 1800 KHz
- +Offset Level value for frequency '<carrier frequency> + <offset>'
- -Offset Level value for frequency '<carrier frequency> - <offset>'
- Limit Level value, either relative or absolute (see MOD)
- Status Evaluation of the single measurement; indication of the "worse" value of the two offset test points

The single status can take the values PASSED, MARGIN or FAILED. All measured values which do not have the status PASSED are marked with an asterisk (*) after the unit.

f) Table Contents MOD

The following applies to all result tables: The first column contains an order number which is assigned to all entries which have not the status PASSED. So it is possible to recognize whether a single measurement is ok or not.

Measurement in the carrier band (ARFCN ± 1.8 MHz)

The results are output for all measurements relative to the carrier:

- Number optional, only available if status is not PASSED
- Frequency offset 100 / 200 / 250 / 400 / 600 / 800 / 1000 / 1200 / 1400 / 1600 / 1800 KHz
- +Offset Level value for frequency '<carrier frequency> + <offset>'
- - Offset Level value for frequency '<carrier frequency> - <offset>'
- Limit Level value, either relative or absolute (see below)
- Status Evaluation of the single measurement; indication of the "worse" value of the two offset test points

The single status can take the values PASSED, MARGIN, EXC or FAILED. All measured values which do not have the status PASSED are marked with an asterisk (*) after the unit.

Measurement in the Tx band out of ± 1.8 MHz

The table contains up to 4 blocks which stands for one of the sections

(- TX ... ARFCN-6), (ARFCN-6 ... ARFCN-1.8), (ARFCN+1.8 ... ARFCN+6), (ARFCN+6 ... +TX).

If the section is empty (because ARFCN lies on the band limit), the corresponding block is completely missing.

Each block has at least a sum line which indicates the range limits (start frequency – stop frequency), the maximum level measured in this range, the associated limit and the global evaluation of this block.

Then the measured values which have not the status PASSED are numbered consecutively.

Under ideal conditions, this list is empty so that the table only contains the 4 range indications.

Incorrect single measurements are output with the following information:
Consecutive numbering (1 to n)

- Frequency range 'from – to', in the channel spacing 200 kHz
- Measured level indication in dB or dBm, see below
- Limit value indication in dB or dBm, see below
- Status Evaluation of single measurement
- Indication of { MARGIN | EXC | >FAILED< }

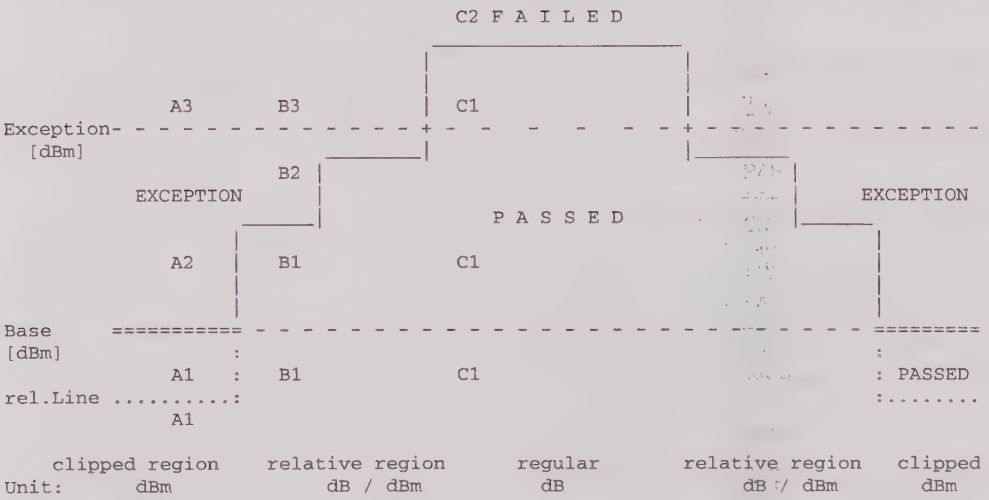
Level indication for TX and ± 1.8 MHz measurements:Depending on the position of the test point and the definition of the limit value, the following decision is taken for the table data dB/dBm (see diagram in chapter 3.3.10.3, Special Features with Relative Limit Lines).

If the test point is above an absolute line, the measured value and line value are output as absolute values, if both are in the relative region, they are also output as relative values. The 'clipped region' in the above diagram is an absolute line since the relative limit value is limited by an absolute value. The measured value and the limit value are output as absolute values for absolute limit values.

This means in detail:

Table 3-4 Level indication depending on measurement result

Test point	Description	Evaluation	Unit
A1	Value in the absolute region (line limited by base).	PASSED	dBm
A2	Tolerance zone, measured value is in the absolute region (clipped).	EXC	dBm
A3	The measured value is above the limit.	FAILED	dBm
B1	Below the normal relative line, base line has no influence on the limit value.	PASSED	dB
B2	Above the normal relative line, base line has no influence on the limit value.	EXC	dB
B3	The absolute limit value has been exceeded.	FAILED	dBm
C1	Base line and tolerance have no influence on the limit value.	PASSED	dB
C2	The relative line has been exceeded.	FAILED	dBm



Measurement in the Rx band

All frequencies at which an event occurred are output (event: the measured level exceeds the permissible limit (FAILED) or lies very near to it (MARGIN)). The measurement is performed in steps of 200 kHz. One frequency is output at maximum for each channel.

g) Table Contents SPU

As in the MOD-Tx display, the table contains different blocks, each of them representing a frequency section of the measured band. A section is defined as the frequency range of a band within which identical measurement specifications are given.

Example Tx band PGSM-II: There are 4 regions related to the carrier frequency, which require various bandwidths depending on the spacing to the frequency.

Example <> Tx Band: Measurement bandwidths and limit values vary depending on the frequency.
Each block has at least a sum line which indicates the range limits (start/stop frequency), the maximum level measured in this range, the associated limit and the global evaluation of this block.

Then the measured values which have not the status PASSED are numbered consecutively.
Under ideal conditions, this list is empty so the table only contains the range indications.

Incorrect single measurements are output with the following information:

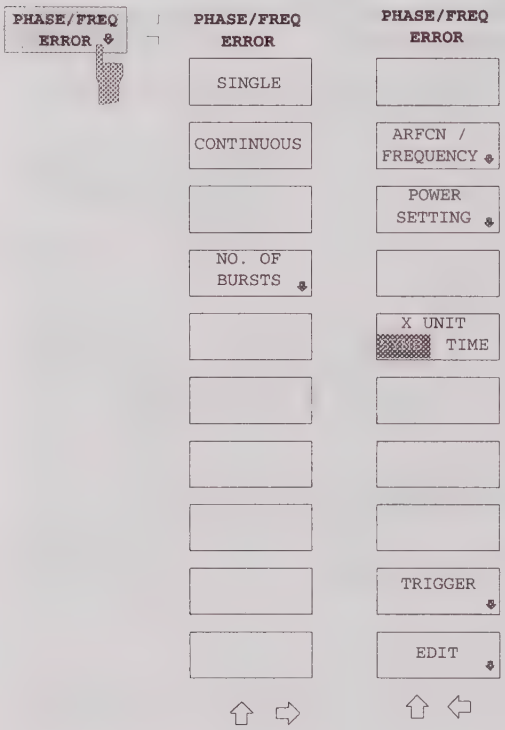
- Consecutive numbering (1 to n)
- Frequency range, depending on section
- Measured level in dBm
- Limit value in dBm

Status, evaluation of the single measurement, indication of { MARGIN I EXC I >FAILED< }

3.4 Measurement of Phase and Frequency Error

Note: *The phase and frequency error can be measured only if option FSE-B7 is installed. If this is not the case, the softkey is not available.*

In this measurement, the phase accuracy of each of the 147 useful symbols is determined separately in accordance with GSM 05.05 and GSM 11.10, and the RMS phase error over the useful symbols as well as the maximum phase error are displayed.
From the phase of the symbols, the frequency error is calculated in conformance with standards and displayed.



The *PHASE/FREQ ERROR* softkey opens a submenu for configuring the measurement of the phase and frequency error in accordance with the selected standard.

The basic settings can be made in the righthand side menu of this submenu without switching to the *SETTINGS* menu.

In addition, the limit values used can be changed in this submenu by means of the *EDIT* softkey. The settings made with the *EDIT* softkey are effective only for the type of measurement for which they were made.

After completion (and during) the measurement, the summary status of the numeric modulation errors is displayed in window A. Error calculation is performed over the 147 useful bits.

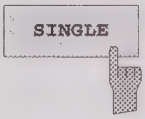
- Max Hold value and average of peak values of phase error
- Max Hold value and average of RMS values of phase error
- Max Hold value and average value of frequency error

Window B displays the phase error versus time, ie over the 147 useful bits of the normal burst. Three traces are displayed at the same time:

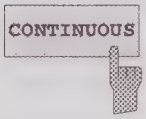
- Trace No. 1:Clear Write
- Trace No. 2: Max Hold
- Trace No. 3: Min Hold.

The midamble selected in the *SETTING* menu is used for synchronization. For measurements of DUTs not emitting a midamble see notes under the *NO.OF BURSTS* softkey.

In addition to the values of this measurement required according to standards the *TRIG TO SYNC START* value is displayed. This value marks the time from the start of the trigger to the first bit of the first symbol of the midamble.



The *SINGLE* softkey triggers a single measurement over the selected number of bursts.



The *CONTINUOUS* softkey triggers a continuous measurement until another measurement function is called up.

The *NO. OF BURSTS* softkey activates a submenu in which the number of burst to be taken into account in the measurement can be defined.

With the *SET MANUAL* softkey , a user-defined number of bursts can be set. The default setting is 1 burst.

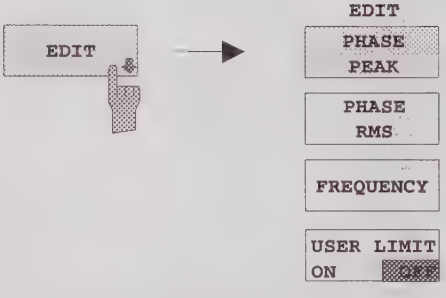
With the *SET TO STANDARD* softkey, the number of bursts is set to the value stipulated by the currently selected standard.

For the phase/frequency error measurement, this is 200 bursts for all standards.

Caution: *With NO. OF BURSTS = 1, 147 symbols are measured after the trigger event (taking into account the delay set under Trigger Adjust), and the result is displayed in a table.*

With NO. OF BURSTS = 1, even measurements are taken into account in which no midamble or burst was found.

With No. of bursts > 1, errors are determined only for those bursts in which the midamble was found.



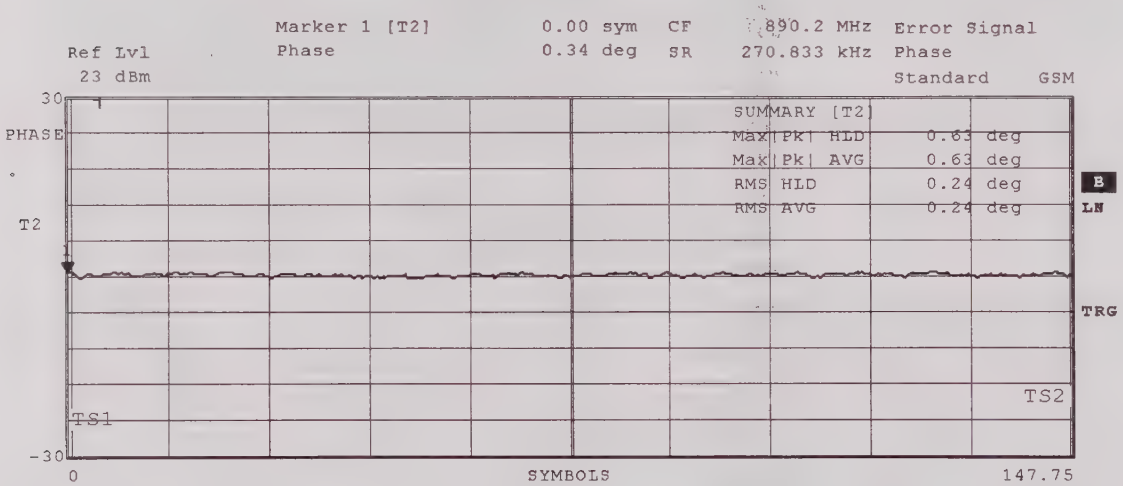
The *EDIT* softkey activates a submenu in which the limit values for the measurement can be defined.

The limit values for the phase and frequency error can be changed in the corresponding input window using the numeric keypad or the spinwheel of FSE/FSIQ. The frequency error is entered in ppm (parts per million).

Phase/Frequency Error

ARFCN: 1 Status: FAILED
Frequency: 890.20000 MHz
Carrier Power: 20.00 dBm Trg to Sync Start: 255.9 µs
Ext. Att/Gain: 20.00 dB
No. of Bursts: 1

ERRORS	CURRENT	MAX HOLD	AVG	LIMIT	STATUS
Phase Pk	0.63 °	0.63 °	0.63 °	20.00 °	PASSED
Phase RMS	0.24 °	0.24 °	0.24 °	5.00 °	PASSED
Freq	-573.20 Hz*	-575.79 Hz*	-573.20 Hz*	0.10 ppm	FAILED



Date: 3.SEP.1999 15:45:48

Fig. 3-4 Measurement of phase and frequency error

3.4.1 Additional Information

Abbreviations used:	SigPwr	(Expected) signal power, defined by current settings for the power class and power control level
	F(ARFCN)	Operating frequency determined by the frequency setting
	ExtAtt	External attenuation
	NOB	Number of bursts – value set by the user for the number of sweeps
Premeasurement:		None
Main measurement:		Split screen, display of results above, trace below; vector mode (ie IQ mode) SingleSweep, ZeroSpan; Center = F(ARFCN);
		Result: Max. and average phase errors and max. frequency error plus limit values.
		Trace: Phase error versus burst characteristic
	InpAtt	Auto Low Noise (min. –20 dBm at mixer)
	RefLvl	3.0 + SigPwr
	Display:	Y unit DEGREES, 6 deg/div X unit SYMBOLS, 148 FullScale Display lines at 0.5 and 147.5 symbols
	VA settings:	Memory size 2048
		ResultLength 148
		FrameLength 300
		Points/symbol 4
		SyncOffset 61
		Find Sync/Burst ON/ON
	Trace 1:	MAX/HOLD
	Trace 2:	Result
	Trace 3:	CLEAR/WRITE
	Trace 4:	MIN/HOLD
	Trigger delay:	-100 µs
	NOB	200
Limits:		
	Phase error (average)	5°
	Phase error (peak)	20°
	Frequency error (rel.)	$10 * 10^{-8}$

3.5 Measurement of Carrier Power

The carrier power measurement serves to measure the maximum output power of the mobile as well as the powers at the individual power control levels in compliance with the selected standards.

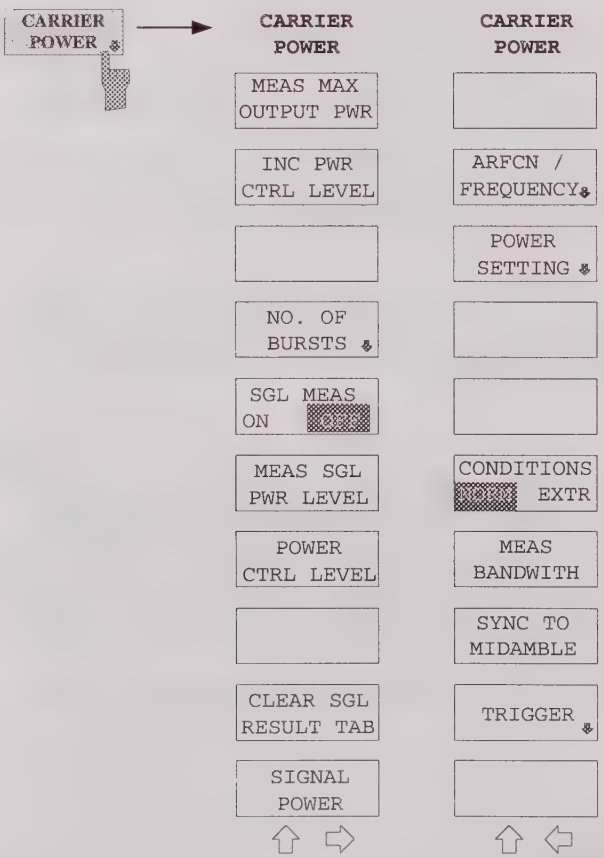
Two test procedures are possible with FSE/FSIQ:

1. All power control levels of the mobile that are possible in the selected power class can be measured starting from the maximum power in descending order in full compliance with standard stipulations (*MEAS MAX OUTPUT PWR, INC PWR CTRL LEVEL*). The result is displayed in a table.
2. The user can select the power control levels and measure them. (*MEAS SGL PWR LEVEL, SET SGL CTRL LEVEL, CLEAR SGL RESULT TAB*). The result is displayed in a table with max. 40 entries (lines).

To measure the carrier power, the power in the frequency channel is determined during the 147 useful bits by means of a zero span measurement. Starting from the maximum possible power control level of the selected power class, the power of the mobile is reduced by one power control level at a time (procedure 1) or set to the selected power control level (procedure 2). Each power control level is measured separately.

When the *CARRIER POWER* menu is opened, the values measured according to procedure 1) are displayed in a table. To display the table obtained with procedure 2), press the *SET SGL CTRL LEVEL* softkey.
Both tables are empty after a cold start.

Menu: *CONFIGURATION MODE – GSM MS ANALYZER*



The *CARRIER POWER* softkey opens a submenu for configuring the measurement of the average power of the signal during a burst. Synchronization to the midamble can be effected by pressing the *SYNC TO MIDAMBLE* key. This function provides an accurate, current time reference. If the key is not pressed, triggering is effected by means of the selected trigger source and the time reference set in the trigger menu (*TRIGGER ADJUST*).

If option FSE-B7 is not installed or *SYNC TO MIDAMBLE* not activated, the trigger time can be corrected with *ADJUST TRIGGER (trigger menu in side menu of measurement).*

Please note that upon opening the measurement according to 1.) (measurement according to standard) the *OUTPUT POWER* and *POWER CTRL LEVEL* displayed under *SETTINGS* are set to the maximum possible power in the selected power class.

This setting is retained after exiting the carrier power measurement.

The availability of the softkeys of the *CARRIER POWER* menu depends on the status of the softkeys *SGL MEAS ON/OFF* and *LIMIT/PWR COUPLED* (in the *POWER SETTINGS* menu) in the manner described below. The softkeys of the righthand side menu are always available.

SGL MEAS OFF and *LIMIT/PWR COUPLED*

The following softkeys are available:
- *MEAS MAX OUTPUT PWR*
- *INC PWR CTRL LEVEL*
  Only if the reference power was measured with the *MEAS MAX OUTPUT POWER* softkey.
- *NO. OF BURST.*

SGL MEAS OFF and *LIMIT/PWR* uncoupled

This combination is not meaningful since measurements against limit values are not possible without reference to the power class and power control level.

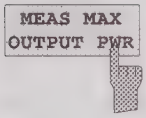
SGL MEAS ON and *LIMIT/PWR COUPLED*

The following softkeys are available:
- *NO. OF BURST*
- *MEAS SINGLE PWR LEVEL*
- *POWER CTRL LEVEL*
- *CLEAR SGL RESULT TAB*

SGL MEAS ON and *LIMIT/PWR* uncoupled

The following softkeys are available:
- *NO. OF BURST*
- *MEAS SINGLE PWR LEVEL*
- *CLEAR SGL RESULT TAB*
- *SIGNAL POWER*

In this case too no reference to the power class and power control level can be established.
However, this setting allows the power to be measured in line with the standard at a single keystroke (*MEAS SGL PWR LEVEL*).

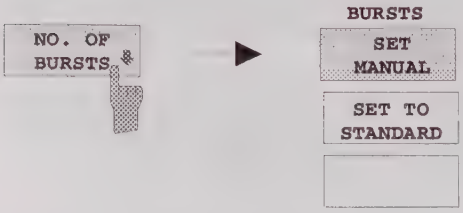


The *MEAS MAX OUTPUT PWR* softkey is used for determining the current average carrier power at full power of the mobile (depending on the currently set power class) and checking it against limit values. The mobile must be set to full power prior to this measurement.

The *INC DYNAM PWR CTRL* softkey increments the power control level of FSE/FSIQ in steps of 1 and checks the measured carrier power against the predefined limit value. The mobile power has to be adjusted accordingly.

When power control level 19 (with GSM standard phase II) or level 15 (with DCS standard phase II or PCS) is attained, the measurement sequence is completed. The test results are displayed in tabular form.

In case of uncoupled Limit/PWR the measurement (according to 1.) is not available.

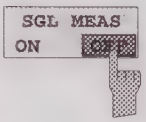


The *NO. OF BURSTS* softkey opens a submenu for defining the number of bursts over which the carrier power is to be averaged.

The *SET MANUAL* softkey opens a window for entering a user-defined number of bursts. The default setting is 1 burst.

With the *SET TO STANDARD* softkey, the number of bursts stipulated by the selected standard is set.

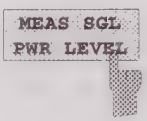
For power measurements, this value is 1 for all standards.



The *SGL MEAS ON/OFF* softkey selects the mode in which the measurement is to be carried out. The default setting is OFF.

OFF All *PWR CTRL LEVEL* values of the selected power class can be measured starting from the maximum power in descending order in full compliance with standard stipulations *(MEAS MAX OUTPUT PWR, INC PWR CTRL LEVEL)*. The result is displayed in a table.

ON The user can select the *PWR CTRL LEVEL* values and measure them. (*MEAS SGL PWR LEVEL, POWER CTRL LEVEL, CLEAR SGL RESULT TAB*).
The results are displayed in a table with max. 40 entries (lines).



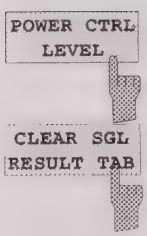
The *MEAS SGL PWR LEVEL* softkey activates test procedure 2 described above. The user can select a power level to be measured.

The power control level set by means of the *SET SGL CTRL LEVEL* softkey described below is measured. The result is displayed in a table.

If the *MEAS SGL PWR LEVEL* softkey is pressed a second time, the measurement at the set power control level is performed again. The results are displayed in a table in chronological order.

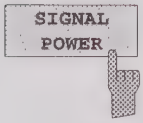
Upon the 40th entry, a further entry will cause the entry that is first in the table to be cleared. Between the measurement steps, the spinwheel or the *UP* and *DOWN* keys can be used to scroll in the table.

This softkey is available only if *SGL MEAS ON/OFF* is switched to ON.



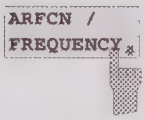
The *PWR CTRL LEVEL* softkey activates the selection of the power control level to be measured (within the range limited by the power class).
This softkey is available only if *SGL MEAS ON/OFF* is switched to ON.

The *CLEAR SGL RESULT TAB* softkey clears the result table created by means of the *MEAS SGL PWR LEVEL* softkey.
This softkey is available only if *SGL MEAS ON/OFF* is switched to ON.

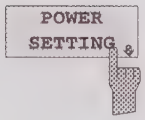


The *SIGNAL POWER* softkey opens a window for entering the actual MS output power present at the analyzer (the external attenuation is taken into account by the analyzer).

This softkey is identical with the softkey in the *POWER SETTING* menu and available only if the coupling between limits/power classes and actual power is deactivated (*LIMIT/PWR COUPLED* in the Power Settings menu).

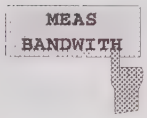


This softkey opens the submenu for frequency setting described under SETTINGS.

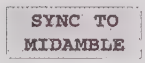


This softkey opens the submenu for power setting described under SETTINGS.

The *CONDITIONS NORM/*EXTR softkey defines whether the mobile is to be checked under normal or extreme conditions. The limit values change correspondingly.



The *MEAS BANDWIDTH* softkey opens a table for selecting the FSE/FSIQ bandwidth for this measurement. The table offers discrete values as well as the *STANDARD* setting (measurement bandwidth in compliance with standard).



This softkey is available only if the optional Vector Signal Analyzer FSE-B7 is fitted.

In the default setting, the *SYNC TO MIDAMBLE* softkey is activated. This means that synchronization to the midamble of a burst is active. This guarantees that an accurate time-reference is always established for the burst. The midamble can be selected in the *SETTINGS/MIDAMBLE* menu.

SYNC TO MIDAMBLE must be switched off when working with DUTs emitting no midamble. FSE/FSIQ in this case triggers only on the edge of the selected trigger source (see *SETTINGS* menu). The time reference to the 147 useful bits is to be established by appropriate trigger setting.

The *TRIGGER* softkey opens the submenu TRIGGER for convenient trigger setting.

E-GSM 900 CARRIER POWER

ARFCN: 999 Status: FAILED
Frequency: 885.00000 MHz Sync:MIDAMBLE RBW: 1 MHz
Nominal Power(max): 39.0 dBm Conditions: NORMAL
Ext Atten: 35.0 dB No of Bursts: 3

No	PWR CTRL LVL	NORM PWR dBm	MEAS PWR dBm	LIMIT PWR min.. max dBm	MEAS DELTA dB	LIMIT DELTA min.. max dB	STATUS
1	2	39.0	39.1	37.0.. 41.0			PASSED
2	3	37.0	37.2	34.0.. 40.0	-1.9	-3.5.. -0.5	PASSED
3	4	35.0	35.2	32.0.. 38.0	-2.0	-3.5.. -0.5	PASSED
4	5	33.0	33.2	30.0.. 36.0	-2.0	-3.5.. -0.5	PASSED
5	6	31.0	31.3	28.0.. 34.0	-1.9	-3.5.. -0.5	PASSED
6	7	29.0	29.3	26.0.. 32.0	-2.0	-3.5.. -0.5	PASSED
7	8	27.0	27.2	24.0.. 30.0	-2.1	-3.5.. -0.5	PASSED
8	9	25.0	25.2	22.0.. 28.0	-1.9	-3.5.. -0.5	PASSED
9	10	23.0	23.2	20.0.. 26.0	-2.0	-3.5.. -0.5	PASSED
10	11	21.0	21.2	18.0.. 24.0	-2.0	-3.5.. -0.5	PASSED
11	12	19.0	19.2	16.0.. 22.0	-2.0	-3.5.. -0.5	PASSED
12	13	17.0	17.2	14.0.. 20.0	-2.0	-3.5.. -0.5	PASSED
13	14	15.0	13.2	12.0.. 18.0	-4.0	-3.5.. -0.5	>FAILED
14	15	13.0	13.2	10.0.. 16.0	0.0	-3.5.. -0.5	>FAILED
15	16	11.0	11.2	6.0.. 16.0	-2.0	-3.5.. -0.5	PASSED
16	17	9.0	9.2	4.0.. 14.0	-2.0	-3.5.. -0.5	PASSED
17	18	7.0	7.1	2.0.. 12.0	-2.1	-3.5.. -0.5	PASSED
18	19	5.0	5.2	0.0.. 10.0	-1.9	-3.5.. -0.5	PASSED

EXT

Fig. 3-5 Table with results of carrier power measurement

P-GSM 900 II CARRIER POWER(INDIVIDUAL)

No	Pwr Ctrl Lvl	ABS POWER dBm	ARFCN	FREQUENCY	COND	EXT ATTEN dB	RBW kHz	BURST COUNT	MEAS POWER dBm	Status
1	11	21.00	1	890200000	NORM	20.00	1000	1	20.83	PASSED
2	11	21.00	1	890200000	NORM	20.00	1000	1	20.83	PASSED
3	12	19.00	1	890200000	NORM	20.00	1000	1	18.83	PASSED
4	12	19.00	1	890200000	NORM	20.00	1000	1	18.83	PASSED
5	13	17.00	1	890200000	NORM	20.00	1000	1	15.72	PASSED
6	13	17.00	1	890200000	NORM	20.00	1000	1	15.72	PASSED
7	14	15.00	1	890200000	NORM	20.00	1000	1	12.65	PASSED

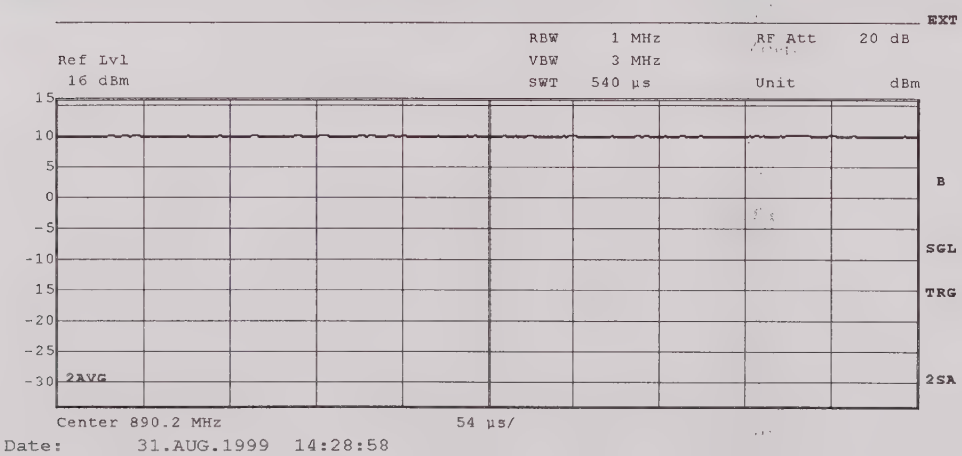


Fig. 3-6 Table with results of carrier power individual measurement

3.5.1 Additional Information

a) Scalar measurements (referred to trigger)	Settings on FSE/FSIQ:	
	1st measurement step:	Table in screen A, trace in screen B. Trace 2 AVERAGE/SAMPLE, Trace 1/3/4 BLANK. Zero span, center frequency = f(ARFCN); sweep time 540 µs, trigger delay 18 µs; scale LOG 50 dB, Ref/Max = SigPwr+3, RFAtt AUTO; RBW = 1 MHz (default), VBW = RBW*3 SigPwr: maximum possible power of mobile
	Subsequent steps:	Same as premeasurement; RefLevel/RFAtt are adjusted in accordance with the expected signal power, ie the nominal value of the power control level is adopted. The internal reference level is set to the (expected) signal power ±3 dB
b) Combined analyzer and vector analyzer measurement (sync to midamble)		Generally same as a), with the following vector settings: FIND BURST OFF FIND SYNC ON Frame/Result Length 100 Memory Length 1024 TriggDelay +100 µs (fast decoding) and scalar settings same as a) but with TriggDelay –100 µs to compensate for time jitter.
CPI settings:	Settings on FSE/FSIQ:	Single measurements: settings same as CPW/ 1st measurement, adapted to current user definitions (frequency, signal level, bandwidth, trigger, ...)

Measurement procedure for measurement according to standard (test routine 1)

A precondition for the carrier power measurement is that the settings made in the *SETTINGS* menu are correct for the mobile station under test.

The standards stipulate measurement of the carrier power at all available power control levels. Both absolute power levels and compliance with tolerances have to be checked at each level step.

- The measurement is started with *MEAS MAX OUPUT PWR*. Beforehand, the mobile has to be set to full output power. FSE/FSIQ determines average carrier power based on the set number of bursts. The following is displayed in split-screen mode:

  A table with numerical values and PASS/FAIL indication in the top screen.

  Trace of current carrier power versus time during useful burst duration in the bottom screen.

- The power control level is now increased step by step (via *INCR POWER CTRL LEVEL*) and the carrier power measured.

  Once the maximum power control level has been reached, ie

  =19 for GSM phase 2, E-GSM and R-GSM

  =15 for DCS phase 2 and PCS and GSM Phase 1

  = 10 or 13 for DCS phase 1, depending on power class

  the measurement sequence ends and the following is displayed:

  A table with all numerical measurement results in full-screen mode and overall PASS/FAIL indication in the table head.

  Measurement results exceeding the permissible limits are marked with an asterisk *).

  If the absolute limit as well as the relative level step width are exceeded, both values are marked.

  e table can be scrolled using the spinwheel or the ⇑ and ⇓ keys.

3.6 Measurement of Carrier Power versus Time (Burst Timing)

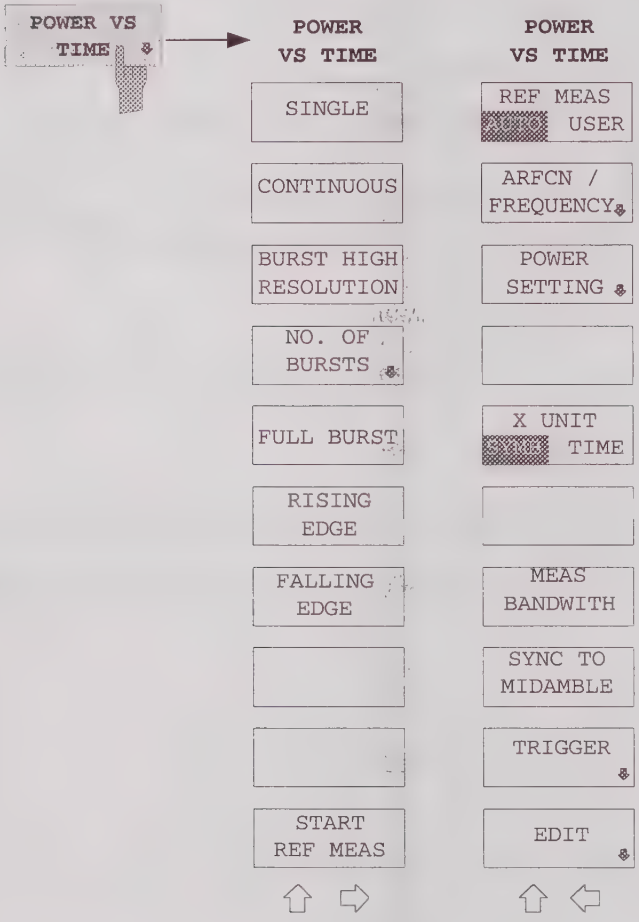
By measuring the carrier power versus time, the time characteristic of the power of a burst can be determined as well as the position of the burst edges relative to the midamble (only with option FSE-B7)
.

The mask of the selected standard is displayed. The characteristic of the carrier power versus time is entered into this mask in the ZERO SPAN mode.

This enables the burst length and the power characteristics of the rising and the falling edge to be checked for compliance with the standard.

Moreover, it is possible to synchronize to the midamble of the burst (only with option FSE-B7) to check whether the burst edges come too early or too late relative to the midamble.

Menu: *CONFIGURATION MODE - GSM MS ANALYZER*



The *POWER VS TIME* softkey opens a submenu for configuring and starting the measurement of carrier power versus time.

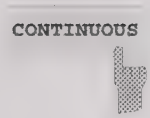
Three traces are displayed after the start of a measurement: Max Peak, Min Peak and Average, with limit checks being effected for Max Peak and Min Peak (this applies to number of bursts > 1; for number of bursts = 1 only one trace is displayed).

4 display modes are available:

- Display of complete burst (*FULL BURST*)
- Display of useful part of burst with high resolution (*BURST HIGH RESOLUTION*)
- Display of rising edge of burst (*RISING EDGE*)
- Display of falling edge of burst (*FALLING EDGE*)

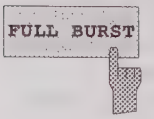
When the measurement is activated, the time characteristic of the burst is displayed on the screen provided that the correct settings have been made.
The mask used for the measured-value diagram depends on the selected standard.

The *SINGLE* softkey activates a single burst measurement (over the number of bursts selected with *NO. OF BURSTS*). In the default setting, FSE/FSIQ measures over one burst.



The *CONTINUOUS* softkey activates a continuous measurement.

The following display modes are available:



The *FULL BURST* softkey

- triggers the measurement of a complete TDMA burst including premeasurement (for level adjustment) (if *REF MEAS -> AUTO*).
- selects the display mode so that the complete burst is presented on the screen (if *REF MEAS -> USER*).
  A premeasurement is not performed.

The relevant limit lines are also displayed.

The *BURST HIGH RESOLUTION* softkey

- triggers the measurement of the useful part of a complete TDMA burst with 1 dB/div level resolution including pre-measurement (for correct level setting) (if *REF MEAS -> AUTO*).
- selects the display mode so that the useful part of the complete burst is presented on the screen with 1 dB/div level resolution (if *REF MEAS -> USER*).
  A premeasurement is not performed.

The relevant limit lines for the 147 useful bits are also displayed.

The *RISING EDGE* softkey

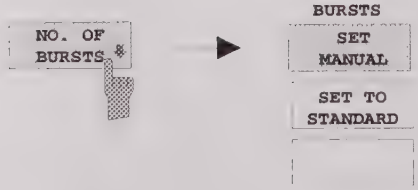
- triggers the measurement of the rising edge of a TDMA burst including pre-measurement (for correct level setting) (if *REF MEAS -> AUTO*).
- selects the display mode such that the rising edge of the burst is presented on the screen (if *REF MEAS -> USER*).
  A premeasurement is not performed.

The relevant limit lines are also displayed.

The *FALLING EDGE* softkey

- triggers the measurement of the falling edge of a TDMA burst including premeasurement (for correct level setting) (if *REF MEAS -> AUTO*).
- selects the display mode such that the falling edge of the burst is presented on the screen (if *REF MEAS -> USER*).
  A premeasurement is not performed.

The relevant limit lines are also displayed.



The *NO. OF BURSTS* softkey opens a submenu for defining the number of bursts over which the carrier power is to be averaged.

The *SET MANUAL* softkey opens a window for entering a user-defined number of bursts. The default setting is 1 burst.

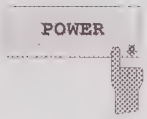
The *SET TO STANDARD* softkey sets the number of bursts in accordance with the selected standard.

For power ramp measurements, the stipulated number of bursts is 1 for all standards.

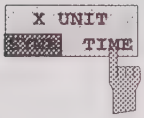
With the *REF MEAS AUTO/USER* softkey it can be selected if a pre-measurement is to be performed prior to each measurement for the correct level setting of FSE/FSIQ or if pre-measurements are to be started exclusively by the user by means of the *START REF MEAS* softkey.
The default setting is AUTO, ie the premeasurement is performed every time.

The *START REF MEAS* softkey starts the pre-measurement for the correct level setting for the *Power vs Time* main measurement.
This softkey is available only if *REF MEAS USER* is selected.

This softkey opens the submenu for frequency setting described under *SETTINGS*.



This softkey opens the submenu for power setting described under *SETTINGS*.



With the *X UNIT SYMB/TIME* softkey it can be selected whether the X-axis unit displayed in the marker field should be time- or symbol-related.
The time reference point is t=0 for symbol 0 (the first 'useful' bit).

The *MEAS BANDWIDTH* softkey activates a window for selecting the desired measurement bandwidth (300 kHz or 1 MHz).

If Standard is selected, the measurement bandwidth is set automatically as required for the selected standard.
(For example for PCS: 300 kHz, for GSM/DCS: 1 MHz).

SYNC TO MIDAMBLE

This softkey is available only if the optional Vector Signal Analyzer FSE-B7 is fitted.

In the default setting, the *SYNC TO MIDAMBLE* softkey is activated. This means that synchronization to the midamble of the burst is active (bit 13/14 transition of midamble). This guarantees that an accurate time-reference is always established for the burst. The midamble can be selected in the *SETTINGS/MIDAMBLE* menu.

SYNC TO MIDAMBLE must be switched off when working with DUTs emitting no midamble. FSE/FSIQ in this case triggers only on the edge of the selected trigger source (see *SETTINGS* menu). The time reference to the 147 useful bits is to be established by appropriate trigger setting.

The exact level reference is established by reference to the average power during the useful part (useful bits) of the burst. For this purpose, FSE/FSIQ measures the average carrier power (average over 540 µs, corresponding to the duration of the useful bits) prior to the screen display and uses it as a reference.

If *SYNC TO MIDAMBLE* is active and NO. OF BURSTS > 1, only those bursts in which the midamble is found are taken into account in the measurement. If the set midamble is not found, SYNC NOT FOUND is displayed and the evaluation of measured values is stopped. When a burst with the set midamble is received, the measurement is continued automatically.

This characteristic can be used to perform a correct measurement provided that SFH is switched on. Only those burst occurring on the set ARFCN will be taken into account.

The *TRIGGER* softkey opens the TRIGGER submenu for trigger setting.

The *EDIT* softkey opens a submenu comprising 5 softkeys.

In this submenu the user-defined limit lines can be specified for the measurement as described in the chapter "Selection of Default Settings", section "Selection and Editing of Limit Lines".

FSE/FSIQ displays the mask for the relevant standard in the measurement diagram. The mask used depends on the selected standard and the power class and power control level settings made under *SETTINGS*. This mask can be changed by means of the EDIT menu.

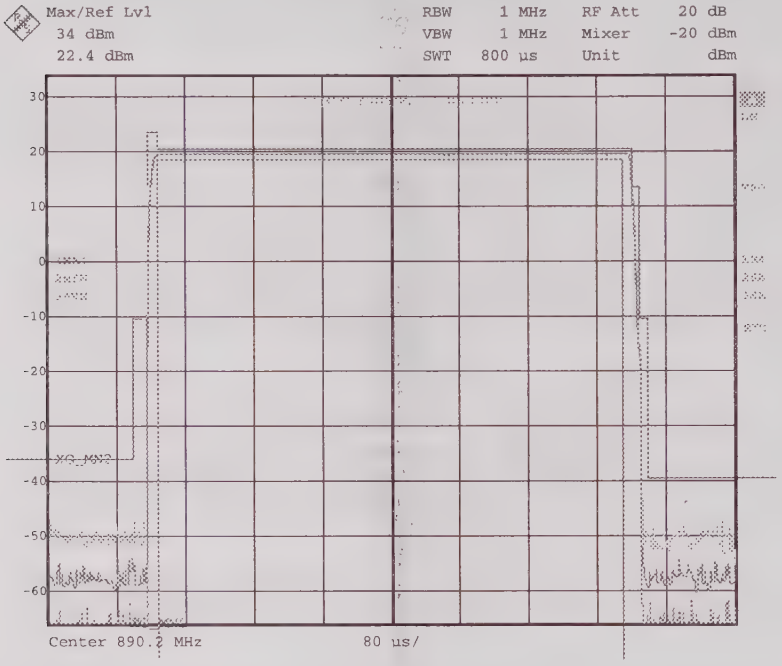


Fig. 3-7 Burst in *FULL BURST* mode

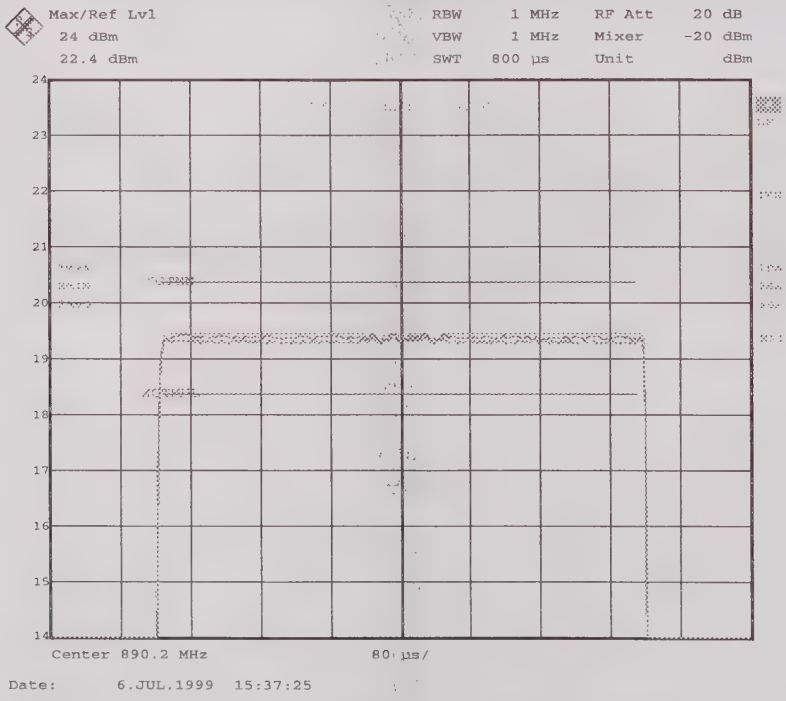


Fig. 3-8 Burst (useful part) in *HIGH RESOLUTION* display mode

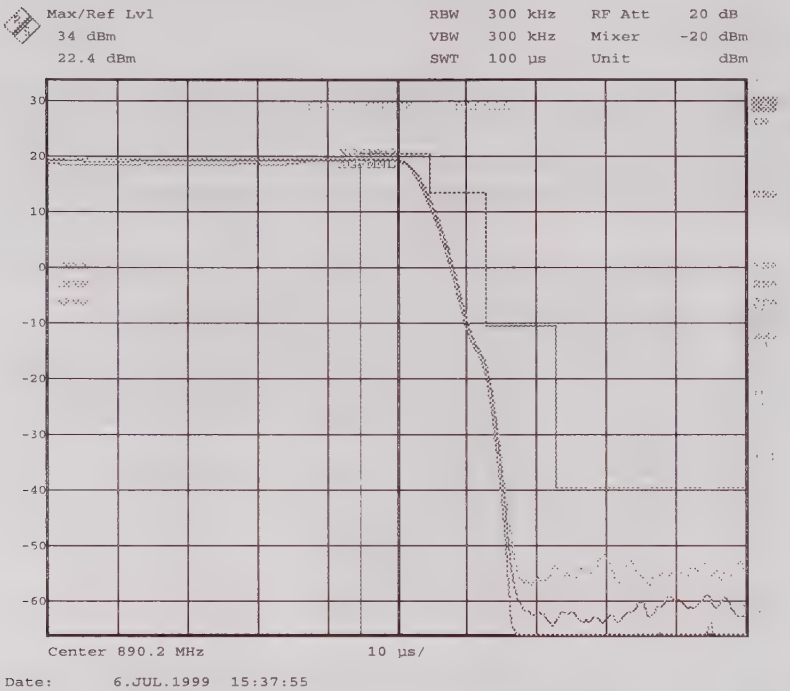


Fig. 3-9 Falling edge of a burst

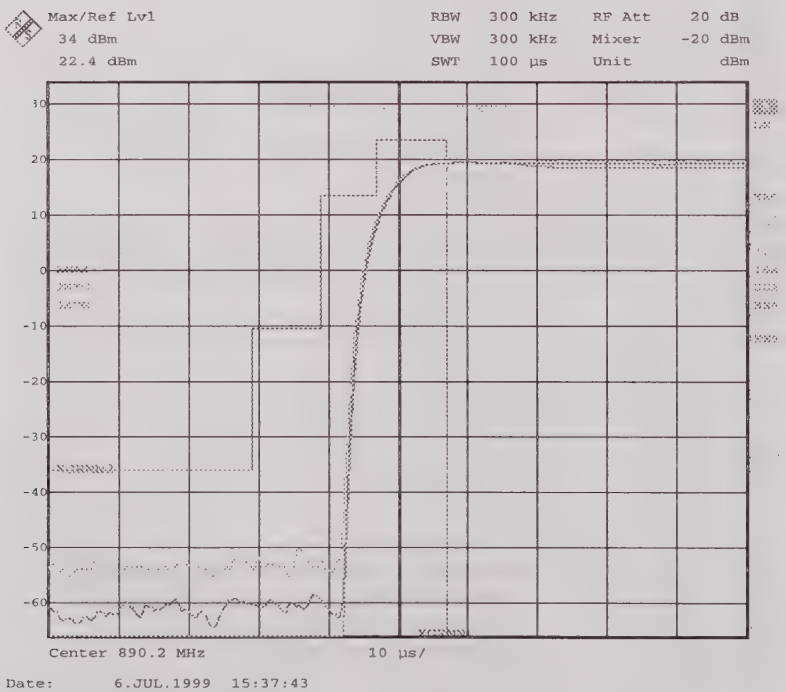


Fig. 3-10 Rising edge of a burst

3.6.1 Additional Information

The measurement can be made with or without synchronization to midamble. Midamble synchronization is available only if option FSE-B7 is fitted. Midamble synchronization enables time-synchronized measurements also with unstable trigger signals (time jitter). However, measurements using midamble synchronization are somewhat slower than pure scalar measurements using a fixed trigger reference because they require demodulation.

Scalar measurements (depending on trigger)	Setting on FSE/FSIQ:	Opening the menu (settings similar to (scalar) main measurement):
		FullScreen, (SingleSweep,) Zerospan; Center = F(ARFCN);
		RBW/VBW Value acc. to standard (300kHz/300kHz for edges or PCS, 1MHz/1MHz for FullBurst and HighRes) or user-defined (300kHz/300kHz or 1MHz/1MHz)
		InpAtt Auto Low Noise
		RefLvl 3.0 + MaxPwr
		MaxLvl 5.0 + MaxPwr
		Display: Y axis LOG_100 dB;
		Trace 1: MAX/HOLD sample
		Trace 2: MIN/HOLD sample
		Trace 3: AVERAGE sample
		Trace 4: BLANK
	1st pre-measurement:	Level measurement is performed over the complete range of the useful bits.
		FullScreen, (SingleSweep,) Zerospan; Center = F(ARFCN);
		RBW/VBW same as settings on opening the menu
		InpAtt Auto Low Noise
		RefLvl 3.0 + SigPwr
		MaxLvl 5.0 + SigPwr
		Display Y axis LOG_100 dB
		NofBursts MIN 2, otherwise NOB)
		Trace 1: BLANK
		Trace 2: AVERAGE sample
		Trace 3: BLANK
		Trace 4: BLANK
	2nd pre-measurement:	FullScreen, (SingleSweep,) Zerospan; Center = F(ARFCN);
		RBW/VBW same as settings on opening the menu
		InpAtt Auto Low Noise
		RefLvl 3.0 + MeasPwr
		MaxLvl 5.0 + MeasPwr
		Display Y axis LOG_100 dB
		NofBursts MIN 20, otherwise NOB
		Trace 1: BLANK
		Trace 2: AVERAGE Sample
		Trace 3: BLANK
		Trace 4: BLANK
	Main measurement:	FullScreen, (SingleSweep,) Zerospan; Center = F(ARFCN);
		RBW/VBW same as settings on opening the menu
		InpAtt taken from premeasurement 2
		RefLvl taken from premeasurement2
		MaxLvl INT (MeasPwr + {15/5/15/15} + 0.5)
		Display Y axis LOG 100/10/100/100 dB (Full/High/Rise/Fall)
		Trace 1: MAX/HOLD sample
		Trace 2: MIN/HOLD sample
		Trace 3: AVERAGE sample
		Trace 4: BLANK

Limit Lines

The FSE-K10 standard uses absolute level values. This allows the reduced steps of FSE-K10 (eg for PGSM-II, CtrLvl 16 to 19) to be used directly for the limit lines.

Base lines:
The limits for all standards have a lower limit in FSE-K10. Temporal asymmetry of the base line must be taken into account for PGSM-II/EGSM/RGSM.
The base line values to be considered for FSE-K10 are:

```
before Burst/after Burst
/* PGSM-I    */  { -36.0  -36.0  },
/* PGSM-II   */  { -36.0, -54.0  }, /* DCS-II/PGSM-II/EGSM spec section 13.3.5 c) */
/* EGSM      */  { -36.0, -54.0  }, /* DCS-II/PGSM-II/EGSM spec section 13.3.5 c) */
/* RGSM      */  { -36.0, -54.0  }, /* DCS-II/PGSM-II/EGSM spec section 13.3.5 c) */
/* DCS-I     */  { -47.0, -47.0  }, /* DCS I spec section II.3.3.2.1 a)           */
/* DCS-II    */  { -48.0, -48.0  }, /* DCS-II/PGSM-II/EGSM spec section 13.3.5 c) */
/* PCS       */  { -48.0, -48.0  }, /* PCS 1900 spec section 5.3.7.2              */
```

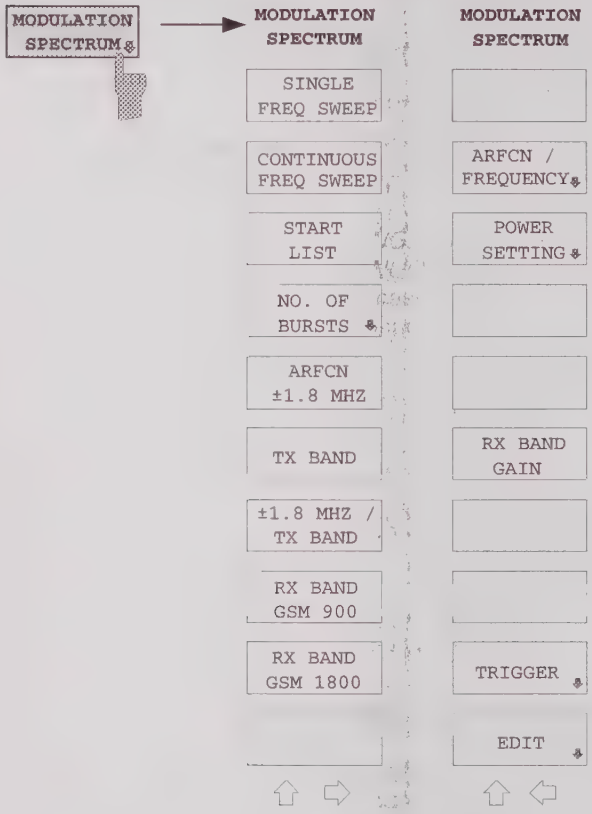
With uncoupled power setting (*LIMIT/PWR COUPLED OFF*), no base line is used.

3.7 Measurement of Spectrum due to Modulation

Modulation, broadband noise and the switching of bursts/power control levels may cause significant interference in adjacent bands.

To eliminate this interference, the measurement described in the following is used to measure adjacent-channel power.

This measurement includes the stipulated measurement of the modulation spectrum in the RX band of both for the user's own standard (eg GSM900) and for the other standards (eg GSM1800).



The *MODULATION SPECTRUM* softkey opens a submenu for configuring and starting the measurement of the spectrum due to modulation.

The function is performed in the analyzer mode with external triggering or with RF POWER TRIGGER.

Video triggering is not possible because in this case the FSE would be tuned to a frequency outside the useful channel (in LIST mode) or the spectrum would be swept (in FREQ SWEEP mode). The measurement can be performed in the zero span mode or in the frequency domain in accordance with standards.

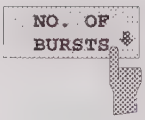
Standards stipulate that a reference level be determined. So, a premeasurement is performed, and the resulting level serves as a reference for selecting limit values and for checking against relative limit values.
For details, see the following section "Additional Information".

The *SINGLE FREQ SWEEP* softkey starts a single frequency sweep, the *CONTINUOUS* softkey a continuous frequency sweep.
In both cases the spectrum is displayed in the form of a trace with limit values depending on the MS output level gained in premeasurement.

The *START LIST* softkey starts a measurement in the zero span mode with the frequency steps and associated bandwidths defined by the standards.
During the measurement, results are displayed in two windows. The lower window shows the level versus time for the frequency offset in question, the upper window the measured results in tabular form.
The actual mobile level, which is needed for selecting the limit values, is determined in a premeasurement.

Upon completion of the measurement sequence, results are shown as a table in full-screen display.

For this measurement, an external trigger or *RF POWER TRIGGER* is to be used for triggering at 50 % to 90 % of the useful part of the burst signal.



The *NO. OF BURSTS* softkey activates a submenu in which the number of burst to be taken into account in the measurement can be defined.

The *SET MANUAL* softkey opens a window for entering a user-defined number of bursts. The default setting is 1 burst.

The *SET TO STANDARD* softkey sets the number of bursts in accordance with the selected standard and the selected band.

At each frequency offset, a number of measurements as defined by *NO. OF BURSTS* is performed. A maximum of 2000 bursts can be measured.
The number of bursts can be reduced to increase measurement speed.

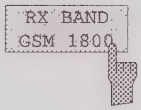
The *ARFCN ±1.8 MHz* softkey starts measurement of the spectrum due to modulation in the range ±1.8 MHz about the set channel.

The *TX BAND* softkey starts measurement of the spectrum due to modulation in the TX band (DCS1800 Phase I) far off the carrier (>±1.8 MHz from the channel frequency). In the case of GSM900 phase II, E-GSM, R-GSM, DCS1800 phase II and PCS1900, the measurement performed by FSE/FSIQ performs the measurements 2 MHz beyond TX band limits. The measurement bandwidth is 100 kHz. With GSM900 phase I, measurement of the spectrum due to modulation is not mandatory for the complete transmission band. The *TX BAND* softkey, therefore, is deactivated for this standard.

Note: *This measurement is available only for GSM900 phase II, E-GSM, R-GSM, DCS1800 phases I and II, and for PCS1900, but not for GSM900 phase I. Furthermore the measurement* ***cannot*** *be performed with RF power trigger but with external trigger only.*

The *±1.8 MHz /TX BAND* softkey is available only in the LIST mode.

FSE/FSIQ measures the ±1.8 MHz and TX BAND frequency ranges one after the other and outputs complete results in the form of a table on completion of the test routine.



The *RX BAND GSM 900* and *RX BAND GSM 1800* softkeys measure the spectrum due to modulation in the receive band of the mobile of the 1800 MHz and 900 MHz mobile radio system. When measurements are performed to PCS standard, the lower softkey is not available while the upper one is labelled *RX BAND*.

The *RX BAND GAIN* softkey is for defining the gain of an external preamplifier (or, in case of negative values, the insertion loss of a diplexer and bandstop filter connected ahead of the analyzer), which is then taken into account in the FSE/FSIQ display. A preamplifier is normally not needed.

The attenuation of an external attenuator entered under *SETTING* is ignored in RX band measurements.

The stringent requirements for spurious emission measurements in the RX band make it absolutely necessary to provide sufficient suppression (max. carrier level <-10 dBm at the FSE/FSIQ input) of the carrier signal(s), eg via bandstop filters or diplexers.

With the setting *RX BAND*, the FSE/FSIQ is switched to an attenuation of 0 dB in order to achieve maximum sensitivity.
The *RX BAND GAIN* softkey defines the gain of the external preamplifier taken into account in the FSE/FSIQ display.

The attenuation value of the external attenuator entered in the *SETTINGS* menu is ignored in measurements on the RX band.

WARNING: *Under no circumstances may the level at the input of the FSE/FSIQ be greater than +20 dBm with 0 dB at the input attenuator.*

If the *RX BAND* softkey is pressed, the following warning appears:

CAUTION:
Connect bandpass or bandstop to suppress TX band!

If *SINGLE FREQ SWEEP* is pressed, the measurement is performed once with averaging over the number of bursts. The measurement can be restarted by pressing the key again.

If *CONTINUOUS FREQ SWEEP* is pressed, the measurement is restarted automatically with averaging over the number of bursts.

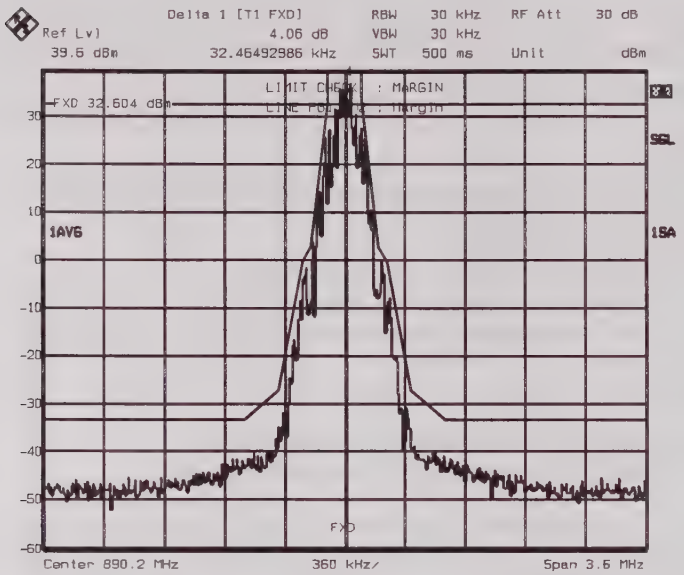


Fig. 3-11 Measurement of the spectrum due to modulation in the ±1.8 MHz range versus carrier frequency

START LIST starts a reference measurement for the ARFCN set. Subsequently, the frequency offsets with respect to the channel frequency are set as required by the specifications and the power for each offset is measured.

The measured values are output in tabular form.

P-GSM 900 II MODULATION SPECTRUM LIST ARFCN ±1.8MHz

ARFCN: 1 Status: FAILED
Frequency: 890.20000 MHz
Carrier Power: 20.0 dBm Ext Atten: 20.0 dB
Ref Pwr (RBW 30 kHz) 10.69 dBm No of Bursts: 1

No.:	Offset Freq.	+Offset	-Offset	Limit	Status
	100 kHz	-10.6 dB	-6.6 dB	0.5 dB	PASSED
1	200 kHz	-34.9 dB *	-35.6 dB *	-30.0 dB	MARGIN
2	250 kHz	-39.7 dB	-25.5 dB *	-33.0 dB	>FAILED<
3	400 kHz	-41.3 dBm*	-44.9 dBm	-36.0 dBm	MARGIN
4	600 kHz	-56.6 dB *	-64.2 dB *	-60.0 dB	EXC
	800 kHz	-92.2 dB	-91.3 dB	-60.0 dB	PASSED
	1000 kHz	-91.5 dB	-91.0 dB	-60.0 dB	PASSED
	1200 kHz	-90.6 dB	-91.8 dB	-60.0 dB	PASSED
	1400 kHz	-90.8 dB	-91.8 dB	-60.0 dB	PASSED
	1600 kHz	-91.8 dB	-90.7 dB	-60.0 dB	PASSED
	1800 kHz	-90.8 dB	-90.7 dB	-60.0 dB	PASSED

EXT

Fig. 3-12 Tabular output of spectrum due to modulation in channel ARFCN ±1.8 MHz

If the value is below the limit and not in the margin, PASSED is output in the status field.

If the value is within the margin, but the limit is not exceeded, MARGIN is output. The frequency is listed separately (No. 1).

If the relative limit, but not the absolute limited of the selected standard is exceeded, EXC (Exception) is output in the status field and a list of the frequencies found. If the permissible number of exceptions is exceeded, FAILED is displayed in the status line (in this case the overall status is also Failed).

3.7.1 Additional Information

SigPwr	(Expected) signal power, defined by current settings for the power class and power control level
MeasPwr	Measured signal power
CorrPwr	Measured signal power, correct by a value depending on the bandwidth (30 kHz RBW: +8 dB)
MaxPwr	Maximum (nominal) output power of DUT
F(ARFCN)	Operating frequency determined by the frequency setting
TxSup	Depending on whether the test parameter Tx suppression is set to ON or OFF, 20 dB or 0 dB will be taken into account in the formula, in IDLE mode in any case 20 dB
ExtAtt	External attenuation
RxGain	RX band gain
SFH	SlowFrequencyHopping factor: 1 for SFH OFF, 3 for SFH ON
NOB	Number of bursts – value set by the user for the number of sweeps

The MOD measurement is implemented as a zero span measurement for GSM and DCS and as a gated frequency sweep measurement for PCS and the overview measurements. So, different settings are required for the different standards and phases.

The measurement is performed over 50% to 90% of the burst, excluding the midamble, for a duration of approx. 170 µs (46 bits).

The measurement section is defined by means of the trigger delay and sweep time in the zero span mode and by gate settings (gate delay and gate length) in the frequency scan mode.

The other GATE settings are taken from the trigger settings (level, mode, polarity, delay, length).

Note: *An external trigger is obligatory for MOD measurements in general and for gated sweep measurements in particular. An RF power trigger does not cover the whole Tx range.*

Absolute limits are defined for the RX band. Therefore, no premeasurements are needed for the RX band.

The transmission band measurement falls into measurements close to the carrier (at +/- 1.8 MHz from the carrier: *ARFCN ±1.8 MHz*) and measurements in the remaining TX band (*TX BAND*). The limit values for TX band measurements are defined on the basis of a reference power on the carrier determined during the premeasurement. The limit values further depend on the type of mobile station and the "actual output power".

The actual output power, which serves as a selection criterion for the limit values, is also determined in the premeasurement. For this, a bandwidth correction value is added to the power value determined in the premeasurement to compensate for the difference resulting from the measurement of the carrier power with a filter bandwidth of 30 kHz instead of "at least 300 kHz", which is also possible. The correction value is 8 dB (in line with GSM 05.50).

The standard defines the limit value close to the carrier only for an offset <1800 kHz.
Therefore, the 1600 kHz offset value is also used for the 1800 kHz offset in the ±1.8 MHz measurement.

The limit value for offset = 1.8 MHz specified by the standards is used only for TX band measurements. The larger bandwidth required for TX band measurements is also taken into account.

So, the following levels are defined in MOD measurements:

- RefPwr — Reference value for relative limit values, measured on the carrier with 30 kHz filter bandwidth
- CorrPwr — Output power, here defined as '(RefPwr + 8.0) dBm', as a selection criterion for limit lines

Gated sweep and gate settings

Frequency sweeps must be gated. The gate settings are derived from the trigger settings and have the same values as the trigger settings:

- Gate Source Trigger source for RF power and EXTERNal; otherwise EXTERNal.
- Gate Delay Corresponding to trigger delay (340.0 µs referred to center of burst, bit transition 13/14)
- Gate Length Corresponding to sweep time of zero span (170.0 µs)
- Gate Level Corresponding to trigger level (default setting: 1.4 V)
- Gate Polarity Corresponding to trigger polarity (default setting: POSITIVE).

EDGE is used as gate mode. It cannot be modified by the user.
For the setting of trigger and gate delay, an additional filter setting time of approx. 30 µs is taken into account.

Settings on opening the menu

The table display is active as usual. Since varied settings are required in the following depending on the selected type of measurement, no settings specific to MOD measurements are made except for the level settings.

The level settings are the same as on opening the TRA menu (see relevant section).

For band measurements the following applies:

Meßbeginn: LIST mode: Switching to split screen; (preliminary) results displayed in screen A, measurement and trace displayed in screen B.

Sgl/Cont With SINGLE/CONT, full-screen display is maintained showing the trace.

3.7.1.1 RX Band Measurements

Defined for all standard-phase combinations (when used with SPU – actually SPU-Rx).

Caution: *The use of a diplexer or suitable notch filter is assumed for RX band measurements. RX band measurements are carried out with high sensitivity !*

Settings:

LIST mode:		
InpAtt	0 dB	
RefLvl	-40 dBm	
Trace 1:	BLANK	
Trace 2:	AVERAGE	Sample
Trace 3:	BLANK	
Trace 4:	BLANK	
RBW/VBW	100 kHz / 100 kHz	
Zero Span, Step	200 kHz	
FrequRange	RX-Band	
SweepTime	170.0µs	
TriggerDelay	340.0 µs	

SINGLE/CONT mode:
FrequencyScan, SingleSweep;
FrequRange: RX band
InpAtt

RefLvl	0 dB	
Trace 1:	- 40 dBm	Sample
Trace 2:	BLANK	
Trace 3:	BLANK	
Trace 4:	BLANK	
RBW/VBW	100 kHz / 100 kHz	
SweepTime	75 ms	
Gated Sweep:	ON	

3.7.1.2 Premeasurement

Premeasurement with split-screen or full-screen display depending on mode (LIST or SINGLE/CONT). Either trace 2 or trace 1 is active. Otherwise the settings are the same in both cases.

Settings

SingleSweep, Zerospan; Center = F(ARFCN);		
RBW/VBW	30 kHz / 30 kHz	
Trigger Delay	340.0 µs	
Sweep Time:	170.0 µs	
InpAtt	MAX (INT ((SigPwr + 3 - ExtAtt + 19.99) / 10) * 10, 0)	
RefLvl	3.0 + SigPwr	
Display	Y axis LOG_100 dB;	
MaxLvl	Coupled to RefLvl	
Trace 1/2:	BLANK	
Trace 2/1:	AVERAGE	Sample
Trace 3:	BLANK	
Trace 4:	BLANK	

The premeasurement is performed in the same way for both the ARFCN ±1.8 MHz and the Tx-band measurements.

3.7.1.3 Main Measurement

a) ARFCN ±1.8 MHz Measurement – Range Close to Carrier

LIST mode:

The measurement is performed in the zero-span mode at the frequency points specified by the standard.
δf = +/- 100, 200, 250, 400, 600, 800, 1000, 1200, 1400, 1600, 1800 kHz offset from F(ARFCN).
Further settings:

SingleSweep		
RBW/VBW	30 kHz / 30 kHz	
TriggerDelay	337.0 µs	
SweepTime:	170.0 µs	
InpAtt		MAX (INT ((CorrPwr - ExtAtt + 19.99) / 10) * 10, 0)
RefLvl		CorrPwr
Display		Y axis LOG_100 dB;
MaxLvl		Coupled to RefLvl
Trace 1:	BLANK	
Trace 2:	AVERAGE	Sample
Trace 3:	BLANK	
Trace 4:	BLANK	
PLL		YIG_CTRL_LOOP_LOW

SINGLE/CONT mode: The measurement is performed as a gated frequency sweep across the range close to the carrier.

FrequencyScan, SingleSweep;	
FrequSpan:	3,6 MHz
Center:	F(ARFCN)
RBW/VBW	30 kHz / 30 kHz
InpAtt	MAX (INT ((CorrPwr – ExtAtt + 19.99) / 10) * 10, 0)
RefLvl	CorrPwr
Trace 1:	AVERAGE Sample
Trace 2:	BLANK
Trace 3:	BLANK
Trace 4:	BLANK
SweepTime	75 ms
PLL	YIG_CTRL_LOOP_LOW
Gated Sweep:	ON

b) TX Band Measurement – TX Band Excluding Range Close to Carrier

LIST mode GSM 900, DCS1800: The measurement is performed in the zero span mode at the frequency points specified by the standard (every 200 kHz, starting at the lower limit of the TX band). The TX band is divided into four ranges:
Tx_{Low} to F(a)-6.0, F(a)-6.0 to F(a)-1.8, F(a)+1.8 to F(a)+6.0, F(a)+6.0 to Tx_{High} [MHz], where (F(a) is the ARFCN frequency. This is because different limits are specified for these ranges.

Further settings:

SingleSweep	
RBW/VBW	100 kHz / 100 kHz
TriggerDelay	340.0 µs
SweepTime:	170.0 µs
InpAtt	MAX (INT ((CorrPwr - 15 - ExtAtt + 19.99) / 10) * 10, 0)
RefLvl	CorrPwr - 15.0
Display	Y axis LOG_100 dB;
MaxLvl	Coupled to RefLvl
Trace 1:	BLANK
Trace 2:	AVERAGE Sample
Trace 3:	BLANK
Trace 4:	BLANK

LIST mode, PCS: The measurement is performed as a frequency sweep, with the whole band being divided into the four or six ranges Tx_{Low} .. F(a)-6.0, F(a)-6.0 .. F(a)-3.0 and F(a)-3.0 .. F(a)-1.8, F(a)+1.8 .. F(a)+3.0 and F(a)+3.0 .. F(a)+6.0, F(a)+6.0 .. Tx_{High} [MHz]. F(a): ARFCN frequency, because different limit regulations apply to these ranges.

Further settings:

SingleSweep	
RBW/VBW	100 kHz / 100 kHz
InpAtt	MAX (INT ((CorrPwr - 15 - ExtAtt + 19.99) / 10) * 10, 0)
RefLvl	CorrPwr – 15.0
Display	Y axis LOG_100 dB;
MaxLvl	Coupled to RefLvl
Trace 1:	BLANK
Trace 2:	AVERAGE Sample
Trace 3:	BLANK
Trace 4:	BLANK
SweepTime	75 ms
Gated Sweep:	ON

SINGLE/CONT mode: The measurement is performed as a gated frequency sweep across the complete range. FrequencyScan, SingleSweep;

FrequSpan:	Tx band	
RBW/VBW	100 kHz / 100 kHz	
InpAtt	MAX (INT ((CorrPwr - 15 - ExtAtt + 19.99) / 10) * 10, 0)	
RefLvl	CorrPwr – 15,0	
Trace 1:	AVERAGE	Sample
Trace 2:	BLANK	
Trace 3:	BLANK	
Trace 4:	BLANK	
SweepTime	75 ms	
Gated Sweep:	ON	

Note: *This Tx measurement is in line with standards only outside range close to the carrier because a uniform bandwidth of 100 kHz is used across the carrier (the measurement is therefore more accurate within the ARFCN ±1.8 MHz range).*

c) TX Band Measurement – Complete TX Band

In this measurement, the two above-described LIST measurements are performed one after the other.

3.7.1.4 Limit lines – Selection, Base Lines, Values

For the RX band, fixed and absolute values are specified.

3.7.1.5 Exceptions

Standards provide for the following exceptions down to a level of max. -36 dBm:

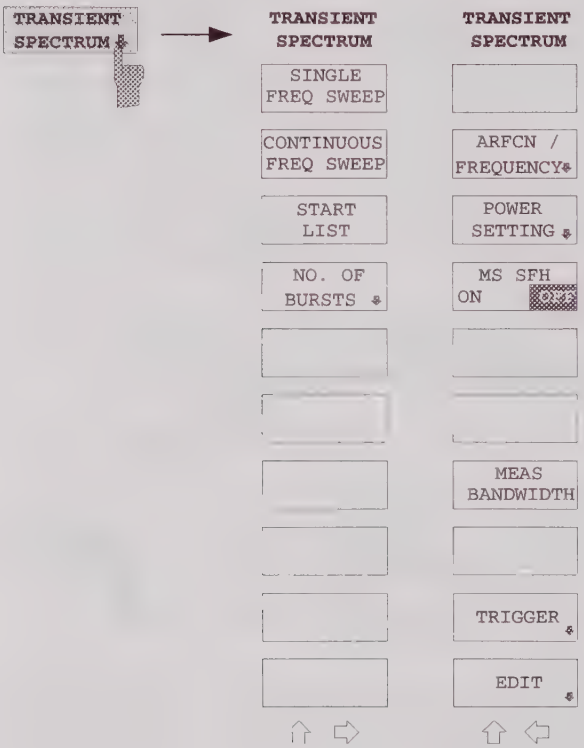
Std/Phase	≤ 6 MHz	> 6 MHz offset
P-GSM-I	1 (0.4 MHz - 1.8 MHz)	None
X-GSM, DCS-II	3 (0.6 MHz -6 MHz)	12
DCS-I	3 (0.6 MHz- 6 MHz)	12
PCS	3 (0.6 MHz - 6 MHz)	12

3.8 Measurement of Spectrum due to Transients

The spectrum due to transients is defined as the spectrum produced by modulation of the carrier and by switching operations of the burst signal .

FSE/FSIQ offers two modes for measuring the spectrum due to transients:

- overview measurement in frequency domain (*SINGLE or CONTINUOUS FREQ SWEEP*) and
- output of measured values in the form of a list (*START LIST*



The *TRANSIENT SPECTRUM* softkey opens a submenu for configuring and starting the measurement of the spectrum due to transients.

The level peaks produced by the switching operations are measured using the max. peak detector and the max. hold function. The result obtained stems from the carrier modulation spectrum and the spectrum due to switching caused by the TDMA burst.

The spectral display of the spectrum due to transients includes the limit values which are dependent on the set power level.

The *SINGLE FREQ SWEEP* softkey starts a single measurement in the frequency domain.
The spectrum is displayed as a trace with limit values selected on the basis of the MS output level (determined in the premeasurement).

The sweep time is influenced by the value entered under *NO. OF BURSTS*. It is set such that each pixel contains the predefined number of bursts.

CONTINUOUS FREQ SWEEP

The *CONTINUOUS* softkey starts a continuous measurement in the frequency domain. The spectrum is displayed as a trace with limit values selected on the basis of the MS output level (determined in the premeasurement).

The sweep time is influenced by the value entered under *NO. OF BURSTS*. It is set such that each pixel contains the predefined number of bursts.

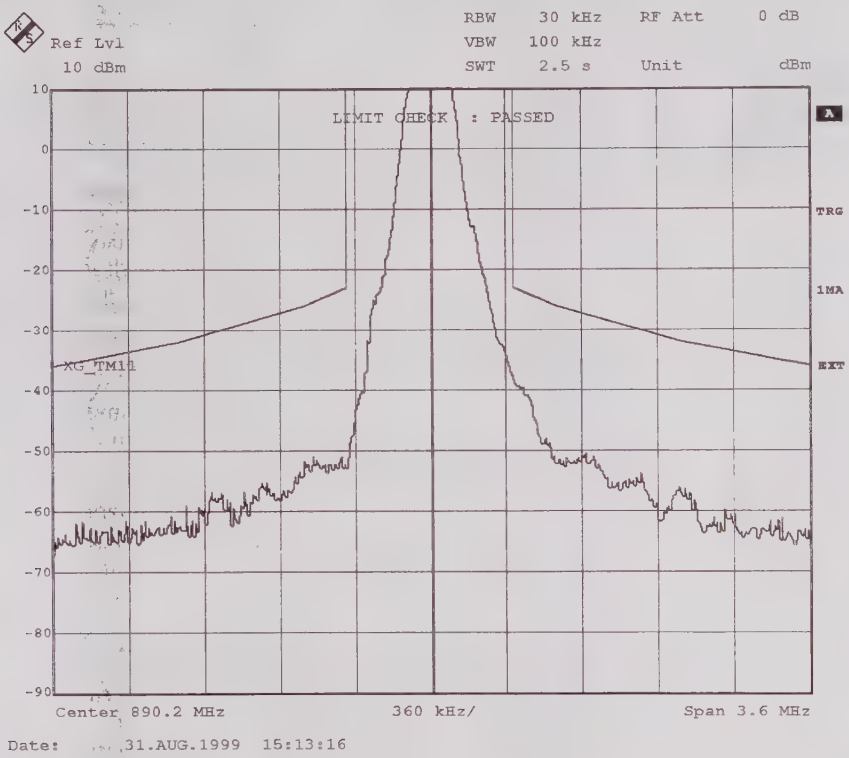


Fig. 3-13 Spectrum due to transients of a GSM mobile for a measurement in the frequency domain. The limit lines as well as the PASSED/FAILED information are displayed.

START LIST

The *START LIST* softkey starts measurement of the spectrum due to transients at the carrier offsets ±400 kHz, ±600 kHz, ±1200 kHz and ±1800 kHz. The results are displayed in form of a table together with the limit values.

The adjacent-channel power is measured in the ZERO SPAN mode at the given offsets by means of the selected channel frequency.

The preset carrier power and the powers measured at the offsets are displayed numerically.

The trigger set under *SETTINGS* is used as trigger source. The measurement is performed over several sweeps, according to the settings made under *NO. OF BURSTS*. The peak values of the individual sweeps are output.

The limit values indicated in the second to last column of the table are derived from the limit line for the selected power level. If a limit value is exceeded, this is marked by *FAILED*, otherwise by *PASSED*. The value exceeding the limit is marked by an asterisk (*).

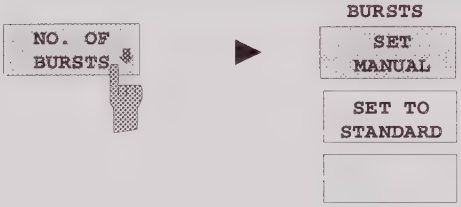
If a measured value is less than 6 dB (settable) below the limit value, this is marked by MARGIN. The value exceeding the limit is also marked by an asterisk (*).

P-GSM 900 II TRANSIENT SPECTRUM LIST

ARFCN:	1	Status:	PASSED
Frequency:	890.20000 MHz		
Carrier Power:	20.0 dBm	Ext Atten:	20.0 dB
Ref Pwr (RBW 300 kHz)	18.64 dBm	No of Bursts:	1

No.:	Offset Freq.	+Offset	-Offset	Limit	Status
	400 kHz	-39.0 dBm	-50.4 dBm	-23.0 dBm	PASSED
	600 kHz	-51.5 dBm	-52.2 dBm	-26.0 dBm	PASSED
	1200 kHz	-55.1 dBm	-60.8 dBm	-32.0 dBm	PASSED
	1800 kHz	-64.4 dBm	-62.8 dBm	-36.0 dBm	PASSED

Fig. 3-14 Spectrum due to transients in list mode. The table shows measured values, limit values and the PASSED/FAILED information for the offset frequencies stipulated by standards as well as a summary PASSED/FAILED information.

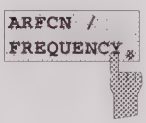


The *NO. OF BURSTS* softkey activates a submenu in which the number of burst to be taken into account in the measurement can be defined.

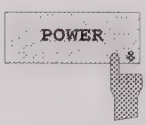
The *SET MANUAL* softkey opens a window for entering a user-defined number of bursts. The default setting is 1 burst.

The *SET TO STANDARD* softkey sets the number of bursts in accordance with the selected standard and phase.

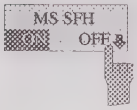
At each frequency offset, a number of measurements as defined by *NO. OF BURSTS* is performed. A maximum of 2000 bursts can be measured.
The number of bursts can be reduced to increase measurement speed.



This softkey opens the submenu for frequency setting described under *SETTINGS*.

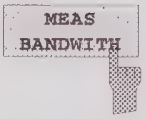


This softkey opens the submenu for power setting described under *SETTINGS*.



The MS SFH ON/OFF softkey is used to select whether FSE/FSIQ is to take into account SFH of the mobile or not.
If SFH is switched on, the sweep time is tripled.
It is assumed that frequency hopping is between channels B, M and T as stipulated by the standard.

So the measurement can be performed during the complete time without any disturbance being caused when the carrier is not at the set ARFCN.



The *MEAS BANDWIDTH* softkey opens a table for selecting the FSE/FSIQ bandwidth for this measurement. The table offers discrete values as well as the STANDARD setting (measurement bandwidth in compliance with standard).

The *TRIGGER* softkey opens the submenu TRIGGER for adjusting the trigger setting.

The EDIT softkey opens a submenu comprising 5 softkeys.

In this submenu the user can define his own limit lines for the measurement as described in the chapter "Selection of Default Settings", section "Selection and Editing of Limit Lines".

3.8.1 Additional Information

Abbreviations used

SigPwr	(Expected) signal power, defined by current settings for the power class and power control level
MeasPwr	Measured signal power
F(ARFCN)	Operating frequency determined by the frequency setting
ExtAtt	External attenuation
SFH	SFH (slow frequency hopping) factor; 1 for SFH-OFF, 3 for SFH-ON.
NOB	Number of bursts – value set by the user for the number of sweeps

Opening the menu:

Full screen with result table

Start of measurement:

LIST mode

Switchover to split-screen display

Screen A: display of (intermediate) results

Screen B: display of trace

In the SINGLE/CONT modes, full-screen display is maintained;
the measurement is performed as a frequency sweep with a trace being displayed.

Opening the menu

FullScreen (A) – tabular display (list mode – result display ON);

Setting of trace display window (screen B):

ZeroSpan, SingleSweep; CenterFrequ = F(ARFCN)

InpAtt	MAX (INT ((SigPwr + 3 - ExtAtt + 19.99) / 10) * 10, 0)
RefLvl	3.0 + SigPwr
Trace 1:	BLANK
Trace 2:	MAX/HOLD Peak
Trace 3:	BLANK
Trace 4:	BLANK

Premeasurement

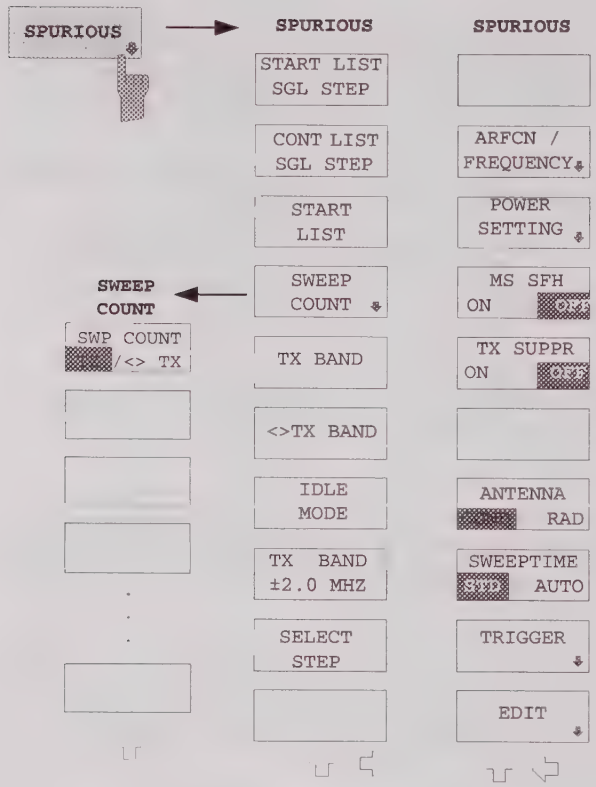
Split screen or full screen, depending on mode (LIST or SGL/CONT). Either trace 2 or trace 1 is active. Otherwise the settings are the same in both cases.

SingleSweep, Zerospan; Center = F(ARFCN);

RBW/VBW	300 kHz / 1 MHz (standard) or user-selected (300/1M or 1M/3M)
TriggerDelay	TrgOffset
InpAtt	MAX (INT ((SigPwr + 3 - ExtAtt + 19.99) / 10) * 10, 0)
RefLvl	3.0 + SigPwr
Display	Y axis LOG_100 dB;
MaxLvl	Coupled to RefLvl
Sweep Time:	5 ms * SFH factor (=3)
Trace 1/2:	BLANK

	Trace 2/1:	MAX/HOLD Peak
	Trace 3:	BLANK
	Trace 4:	BLANK
Main measurement	Sgl/Cont:	Span = 3.6 MHz; Center = F(ARFCN);
	List:	ZeroSpan, Center = F(ARFCN);
	RBW/VBW	30 kHz / 100 kHz
	InpAtt	MAX (INT ((MeasPwr - 15 - ExtAtt + 19.99) / 10) * 10, 0)
	RefLvl	MeasPwr - 15.0
	Display:	Y axis LOG_100 dB;
	MaxLvl	Coupled to RefLvl
	SweepTime	2.5 s * SFH factor (Single/Cont) 5 ms * SFH factor (List)
	PLL	YIG_CTRL_LOOP_LOW
	Trace 1/2:	BLANK
	Trace 2/1:	MAX/HOLD Peak
	Trace 3:	BLANK
	Trace 4:	BLANK
		Test points: ±400, 600, 1200, 1800 kHz; (List)

3.9 Measurement of Spurious Emissions



The *SPURIOUS* softkey opens a submenu for configuring and starting the measurement of spurious emissions.

The standards specify measurements in various frequency bands with different bandwidth settings.

Spurious emissions in the RX band (receive band) are not called with the *SPURIOUS* softkey but with the *MODULATION SPECTRUM* softkey.

The frequency range for performing a measurement in the transmission mode (*ACTIVE MODE*) is defined by means of softkeys *TX BAND or TX BAND ±2.0 MHz* and *<>TX BAND*. Measurement in the idle mode is activated with the *IDLE MODE* softkey.

It is possible to measure when SFH is active. It is assumed that the effect of the hopping carrier is negligible at the distance from the hopping carrier at which the strength of the spurious emission is of interest.

The measurement time is tripled if SFH = ON.

If adequate suppression of the TX band is ensured, the sensitivity of the instrument can be increased by approx. 20 dB with the *TX SUPPR ON/OFF* softkey.

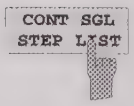
For a fast overview measurement, a measurement time much shorter than that stipulated in the standards can be selected (*SWEEPTIME STD/AUTO*).

For measurements according to the R-GSM standard a normal MS or a SMALL MS can be selected in the POWER SETTINGS menu.

The only difference between these two types are the limit values.

The *SELECT STEP* softkey is for selecting the band sections to be measured (of the band to be tested in accordance with standards).

The *START LIST SGL STEP* softkey starts a step-by-step measurement across the sections selected by means of *SELECT STEP* at the bandwidths stipulated by the standard.
The single-step mode is of advantage where a detailed test report has to be created, for example.



With the *CONT SGL STEP LIST* softkey, the measurement is continued with the next band section in each case (compare *SELECT STEP*).

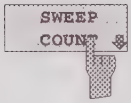
The *START LIST* softkey starts a single measurement sequence across all sections selected by means of *SELECT STEP* at the bandwidths stipulated by the standard.

The display automatically switches to the split-screen mode. The upper window shows a list of spurious emissions, the lower window the spectrum of the current sweep. If the limit value and the margin are not exceeded, the range in question is evaluated PASSED.

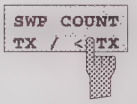
If the measured values are within the margin, the values are evaluated *MARGIN*. If the limit value is exceeded, *FAILED* is indicated.

A new measurement can be started by pressing *START LIST* softkey again.

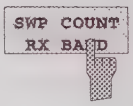
After completion of the measurement, FSE switches to full-screen display. The list of spurious emissions is displayed.



The *SWEEP COUNT* softkey opens up a submenu in which the number of sweeps required for the measurement can be defined.

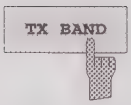


The *SWP COUNT TX /<>TX (Non TX)* softkey allows manual entry of the number of sweeps over which the peak values are measured within and outside the TX band.



The *SWP COUNT RX BAND* softkey opens a window for entering the number of sweeps over which the average is formed in RX band measurements.

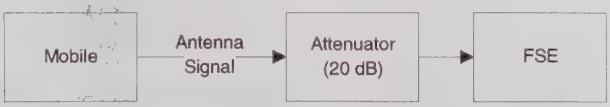
The *SET TO STANDARD* softkey sets the number of sweeps to the value specified by the relevant standard.



The *TX BAND* softkey selects the transmit band of the mobile for measuring spurious emissions.

Measurements in the TX band can be performed with the FSE/FSIQ alone without additional equipment being required.

Measurement setup for TX BAND measurements:



Tabular output of spurious emissions in the TX band:

P-GSM 900 II SPURIOUS LIST TX Band

ARFCN: 1 Status: FAILED
Frequency: 890.20000 MHz
Carrier Power: 20.0 dBm Ext Atten: 20.0 dB

No.	Frequency	Level	Limit	Status
	892.00000 MHz --- 896.20000 MHz	-59.9 dBm	-42 dBm	PASSED
	896.20000 MHz --- 915.00000 MHz	-18.8 dBm	-42 dBm	>FAILED<
1	909.12265 MHz	-18.8 dBm	-42 dBm	>FAILED<
2	908.21844 MHz	-20.0 dBm	-42 dBm	>FAILED<
3	909.83848 MHz	-20.8 dBm	-42 dBm	>FAILED<
4	910.25291 MHz	-35.3 dBm	-42 dBm	>FAILED<
5	908.06774 MHz	-36.0 dBm	-42 dBm	>FAILED<
6	913.37996 MHz	-36.1 dBm	-42 dBm	>FAILED<
7	910.10220 MHz	-36.4 dBm	-42 dBm	>FAILED<
8	907.87936 MHz	-38.6 dBm	-42 dBm	>FAILED<

EXT

Fig. 3-15 Example of a spurious list

The upper part of the table shows the current transmit channel (ARFCN), the nominal carrier power, the currently measured band and the evaluation of the measurement result (status: PASSED/FAILED/ ABORTED/ BLANK).

For each frequency range measured, the limits, the maximum level and the result of the limit check are output. If spurious emissions are measured inside a frequency range, they are listed as single frequencies below the line indicating the frequency range.

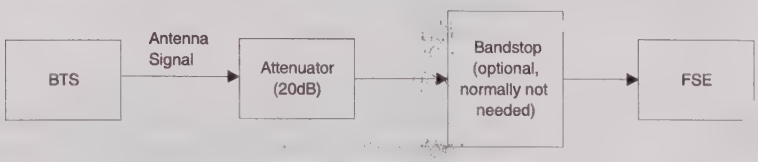
In the *Limit* column the limit values in accordance with the selected standard are displayed. If a limit value is exceeded, *FAILED* is indicated, otherwise *PASSED*. If a measured value is below the limit value by less than the set margin, *MARGIN* is indicated.

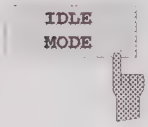
The *<>TX BAND* softkey activates the measurement of spurious outside the transmit band.

Normally, no additional equipment is required for measuring the mobile according to standard.

The measurement sensitivity can be improved by means of a bandstop filter for suppressing the carrier. The bandstop filter should be selected such that the carrier is suppressed by at least 20 dB. The *TX SUPPR ON* softkey can then be used to increase the sensitivity of FSE/FSIQ by 20 dB.

Measurement setup <> TX band::

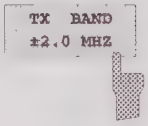




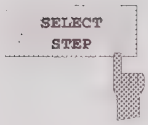
The *IDLE MODE* softkey is used to make the settings for measuring the spurious emissions in the idle mode (IDLE) of the mobile as defined by the standards.
In general, this measurement can also be performed in the free run mode.

The mobile has to be set continuously to the *PAGING REORGANIZATION* mode and *BS_AG_BLKS* to 0.

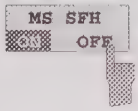
Note: *In the IDLE mode, sweep times are extremely long (up to 4700 s depending on the frequency range) because in this mode the reception of a paging TDMA frame by the FSE must be ensured for each measurement point (measurement frequency).*



The *TX BAND ±2.0 MHz* softkey selects the MS transmit band plus ±2 MHz for measuring spurious emissions.
Thus the characteristics of a carrier close to the band limit, too, can be measured and compared with the TX limit values.
The settings correspond to those of the TX band except for the band extension.

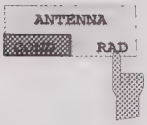


The *SELECT STEP* softkey opens a list of predefined band sections from which the section(s) to be measured can be selected.
All steps to be measured according to standard are selected (default setting).
Band sections can be selected and activated/deactivated by means of the spinwheel, the cursor keys and the unit keys (ENTER).

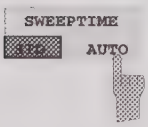


The *MS SFH ON/OFF* softkey is used to select whether FSE/FSIQ is to take into account SFH of the mobile or not.
If SFH is switched on, the sweep time is tripled.
It is thus ensured that the desired number of bursts of the ARFCN to be measured is taken into account.

The *TX SUPPR ON/OFF* softkey is for activating/deactivating higher sensitivity.
The sensitivity of FSE/FSIQ can be increased by means of a bandstop filter for carrier suppression. The bandstop filter should be selected such that the carrier is suppressed by at least 20 dB. The *TX SUPPR ON* softkey can then be used to increase the sensitivity of FSE by 20 dB.



The *ANTENNA COND*/RAD softkey is used to select whether the measurement is to be performed according to the regulation for conducted or radiated spurious emission.
The default setting is COND.



The *SWEEPTIME STD/AUTO* softkey is for selecting the measurement time in accordance with the standard (STD) or the maximum possible measurement time of FSE/FSIQ.

3.9.1 Additional Information

Settings on opening the menu: Full-screen display of result table of (previously) selected band

Start of measurement: Switching to split screen; (preliminary) results displayed in screen A, trace displayed in screen B.
In single-step operation, the markers are available for measurements after each step.

The following settings are relevant:

TxSup Tx suppression.
When ON is selected, a value of 20 dB is taken into account in the formulas for calculating the input attenuation and the reference level. In the case of "K10 idle", "TxSup = ON" is assumed for the calculation.
SFH Slow frequency hopping. For sweep time calculation (see below).
STD Standard/Auto sweep time. For sweep time calculation (see below).

Sweep time: possible settings and calculation: Time always in [µs]

Tx, <>Tx: swptime = (SPAN/RBW) * 577 * <sfh> * <std>
or
swptime = 500 * 577 * <sfh> * <std, falls (SPAN/RBW) < 500
with
<sfh> 3 if SFH==ON, otherwise 1
=
<std> 8 if STD==ON, otherwise 1 (for AUTO sweep time)
=
If the result is below 2.5 s, it is rounded up to the next highest whole tenth of a second.

Idle: Same calculation as <>Tx, plus multiplication by 8 because of multiframe; SFH OFF.

FSE/FSIQ settings:

Settings on opening the menu: Full-screen display of table of (previously) selected band.

All traces BLANK, trace 2 at Peak/MaxHold

Trace 1:	BLANK	
Trace 2:	MAX/HOLD	Peak
Trace 3:	BLANK	
Trace 4:	BLANK	
PLL-BW:	YIG-CTRL-LOOP AUTO	
InpAtt:	MAX (INT ((SigPwr -15 - TxSup - ExtAtt + 19.99) / 10) * 10, 0)	
RefLevel:	SigPwr - 15 - TxSup	

Tx band

RBW/VBW	(depending on carrier offset as per standard specification)
InpAtt	Same as on opening the menu
RefLvl	Same as on opening the menu
SweepTime:	see above

Tx sections:

(Delta F [MHz]	RBW/VBW [kHz]	(sweep time)	
0. ... 1.8	10 / 30	2.4 s	(Phase I only)
1.8 ... 6.0	30 / 100	2.4 s	
> 6.0	100 / 300	2.4 s	

<> Tx band	RBW/VBW	Variable (depending on frequency range as per standard specification)
	InpAtt	Same as on opening the menu
	RefLvl	Same as on opening the menu
	SweepTime:	see above
	PLL BW:	LOW for all frequency sections in part or completely below 10 MHz

<>Tx sections: (from-to[Hz] (PGSM-II, EGSM, RGSM; DCS-II,)

Frequency range			RBW/VBW (kHz)	Sweep time (s)
100 kHz	to	30 MHz	10/30	14.0
30 MHz	to	50 MHz	10/30	9.0
50 MHz	to	500 MHz	100/300	21.0
500 MHz	to	Tx-30 MHz	3000/3000	2.4
Tx-30 MHz	to	Tx-20 MHz	1000/3000	2.4
Tx-20 MHz	to	Tx-10 MHz	300/1000	2.4
Tx-10 MHz	to	Tx-5 MHz	100/300	2.4
Tx-5 MHz	to	Tx-2 MHz	30/100	2.4
Tx+2 MHz	to	Tx+5 MHz	30/100	2.4
Tx+5 MHz	to	Tx+10 MHz	100/300	2.4
Tx+10 MHz	to	Tx+20 MHz	300/1000	2.4
Tx+20 MHz	to	Tx+30 MHz	1000/3000	2.4
Tx+30 MHz	to	4 GHz	3000/3000	4.7
4 GHz	to	12.75 GHz	3000/3000	13.5

<>Tx sections: (from-to[Hz] (PCS 1900)

	Frequency range			RBW/VBW (kHz)	Sweep time (s)
conducted only	100K	to	30M	10/30	14.0
	30M	to	50M	10/30	9.4
	50M	to	500M	100/300	21.0
	500M	to	1G	3000/3000	2.4
	1G	to	1820M	3000/3000	2.4
	1820M	to	1830M	1000/3000	2.4
	1830M	to	1840M	300/1000	2.4
	1840M	to	1845M	100/300	2.4
	1845M	to	1848M	30/100	2.4
	1912M	to	1915M	30/100	2.4
	1915M	to	1920M	100/300	2.4
	1920M	to	1930M	300/1000	2.4
radiated only	1930M	to	1940M	1000/3000	2.4
radiated only	1940M	to	1990M	3000/3000	2.4
	1990M	to	4G	3000/3000	3.1
conducted only	4G	to	12.75G	3000/3000	13.5

<>Tx sections: (from-to[Hz] (PGSM-I; DCS-I analog)	Frequency range			RBW/VBW (kHz)	Sweep time (s)
conducted only	100 K	to	30 M	10/30	14.0
	30 M	to	50 M	10/30	9.4
	50 M	to	500 M	100/300	21.0
	500 M	to	860 M	3000/3000	2.4
	860 M	to	870 M	1000/3000	2.4
	870 M	to	880 M	300/1000	2.4
	880 M	to	890 M	100/300	2.4
/* Tx band interval*/					
	915 MHz	to	925 MHz	100/300	2.4
	925 MHz	to	935 MHz	300/1000	2.4
/* Rx band interval*/					
conducted only	960 MHz	to	4 GHz	3000/3000	4.7
conducted only	4 G	to	12.75 GHz	3000/3000	13.5
radiated only	935 M	to	945 M	1000/3000	2.4
radiated only	945 M	to	960 M	3000/3000	2.4
radiated only	960 M	to	1 G	3000/3000	2.4
radiated only	1 G	to	4 GHz	1000/3000	14.0

The sweep time values for STD and AUTO are listed under *SELECT STEP*.

4 Remote Control

The following chapter is intended to supplement and update chapter 3, section 3.6 and 3.9 of the operating manual for the basic instrument. It contains the commands for options GSM BTS Analyzer (FSE-K11) and GSM MS Analyzer (FSE-K10).

4.1 Description of Commands

4.1.1 CALCulate Subsystem

4.1.1.1 CALCulate:LIMit Subsystem

The CALCulate:LIMit subsystem comprises the limit lines and the corresponding limit checks.

COMMAND	PARAMETERS	UNIT	COMMENT
CALCulate			
:LIMit<1 to 8>			Option FSE-K11 or FSE-K10
:BURSt	--		
:PTEMplate?			query only
:POWer?	--		query only
:SPECtrum	--		
:MODulation?	ARFCn | TXBand | RXBand | COMBined | DCSRx1800		query only
:FAILs?	ARFCn | TXBand | RXBand | COMBined | DCSRx1800		query only
:EXCeptions?	ARFCn | TXBand | RXBand | COMBined | DCSRx1800		query only
:SWITching?			query only
:FAILs?			query only
:SPURious?	TXBand | OTXBand | RXBand | IDLeband	DB	query only
:FAILs?	TXBand | OTXBand | RXBand | IDLeband		query only
:MARGin	<numeric_value>	DB; DB	

CALCulate<1\|2>:LIMit<1 to 8>:BURSt:PTEMplate?

This command queries the result of the limit check for a power vs. time measurement.

Parameter: The result is displayed in character data form. Possible values are:
PASSED limit not exceeded
FAILED limit exceeded
RUNNING measurement not completed

Examples: "CALC:LIM:BURS:PTEM?"

Features: *RST value: --
SCPI: device-specific

Modes: BTS, MS

This command is a query and therefore not assigned a *RST value.
If no measurement has been carried out yet, a query error is triggered off. The numeric suffixes <1|2> or <1 to 8> are not significant for this command.

CALCulate<1|2>:LIMit<1 to 8>:BURSt:POWer?

This command queries the total result of the carrier power measurement.

Parameter: The result is displayed in character data form. Possible values are:

PASSED	limit not exceeded
FAILED	limit exceeded
ABORTED	measurement aborted
RUNNING	measurement not completed

Examples: "CALC:LIM:BURS:POW?"
Result: PASSED

Features: *RST value: --
SCPI: device-specific

Modes: BTS, MS

This command is a query and therefore not assigned a *RST value.
If the command is triggered off before the carrier power measurement was started for the first time, a query error results. The numeric suffixes <1|2> or <1 to 8> are not significant for this command.

CALCulate<1|2>:LIMit<1 to 8>:SPECtrum:MODulation? ARFCn | TXBand | RXBand | COMBined | DCSRx1800

This command queries the total result of the spectrum due to modulation measurement.

Parameter: The result is displayed in character data form. Possible values are:

PASSED	limit not exceeded
FAILED	limit exceeded
ABORTED	measurement aborted
RUNNING	measurement not completed

Examples: "CALC:LIM:SPEC:MOD? RXB"
Result: PASSED

Features: *RST value: --
SCPI: device-specific

Modes: BTS, MS

ARFCn	ARFCN ± 1.8 MHz	TXBand	TX-band
RXBand	RX-band	COMBined	ARFCN ± 1.8 MHz / TX-band
DCSRx1800	RX-Band DCS 1800 (option FSE-K10 only)		

This command is a query and therefore not assigned a *RST value.
The numeric suffixes <1|2> or <1 to 8> are not significant for this command.

CALCulate<1|2>:LIMit<1 to 8>:SPECtrum:MODulation:FAILs? ARFCn | TXBand | RXBand | COMBined | DCSRx1800

This command queries the number of limit violations of the spectrum due to modulation measurement.

Examples: "CALC:LIM:SPEC:MOD:FAIL? RXB"

Features: *RST value: --
SCPI: device-specific

Modes: BTS, MS

ARFCn	ARFCN ± 1.8 MHz	COMBined	ARFCN ± 1.8 MHz / TX-band
TXBand	TX-band	DCSRx1800	RX-Band DCS 1800 (option FSE-K10 only)
RXBand	RX-band		

This command is a query and therefore not assigned a *RST value The numeric suffixes <1|2> or <1 to 8> are not significant for this command.

CALCulate<1|2>:LIMit<1 to 8>:SPECtrum:MODulation:EXCeptions? ARFCn | TXBand | RXBand | COMBined | DCSRx1800

This command queries the number of limit violations of the spectrum due to modulation measurement which are marked as exceptions.

Examples: "CALC:LIM:SPEC:MOD:EXC? RXB"

Features: *RST value: --
SCPI: device-specific

Modes: BTS, MS

ARFCn	ARFCN ± 1.8 MHz	COMBined	ARFCN ± 1.8 MHz / TX-band
TXBand	TX-band	DCSRx1800	RX-Band DCS 1800 (option FSE-K10 only)
RXBand	RX-band		

This command is a query and therefore not assigned a *RST value. The numeric suffixes <1|2> or <1 to 8> are not significant for this command.

CALCulate<1|2>:LIMit<1 to 8>:SPECtrum:SWITching?

This command queries the total result of the spectrum due to switching transients measurements.

Parameter: The result is displayed in character data form. Possible values are:
PASSED limit not exceeded
FAILED limit exceeded
ABORTED measurement aborted
RUNNING measurement not completed

Examples: "CALC:LIM:SPEC:SWIT?"
Result: PASSED

Features: *RST value: --
SCPI: device-specific

Modes: BTS, MS

This command is a query and therefore not assigned a *RST value. The numeric suffixes <1|2> or <1 to 8> are not significant for this command.

CALCulate<1|2>:LIMit<1 to 8>:SPECtrum:SWITching:FAILs?

This command queries the number of limit violations of the spectrum due to switching transient measurement.

Examples: "CALC:LIM:SPEC:SWIT:FAIL?"

Features: *RST value: --
SCPI: device-specific

Modes: BTS, MS

This command is a query and therefore not assigned a *RST value. The numeric suffixes <1|2> or <1 to 8> are not significant for this command.

CALCulate<1|2>:LIMit<1 to 8>:SPURious? TXBand | OTXBand | RXBand | IDLeband

This command queries the total result of the spurious emissions measurement.

Parameter: The result is displayed in character data form. Possible values are:

PASSED limit not exceeded
FAILED limit exceeded
ABORTED measurement aborted
RUNNING measurement not completed

Examples:
```
"CALC:LIM:SPUR? OTXB"
Result:PASSED
```

Features: *RST value: --
SCPI: device-specific

Modes: BTS, MS

TXBand	TX-band
OTXBand	Not TX-band
RXBand	RX-band (option FSE-K11 only)
IDLeband	IDLeband (option FSE-K10 only)

This command is a query and therefore not assigned a *RST value. The numeric suffixes <1|2> or <1 to 8> are not significant for this command.

CALCulate<1|2>:LIMit<1 to 8>:SPURious:FAILs? TXBand | OTXBand | RXBand | IDLeband

This command queries the number of limit violations of the spurious emissions measurement.

Examples:
```
"CALC:LIM:SPUR:FAIL? OTXB"
```

Features: *RST value: --
SCPI: device-specific

Modes: BTS, MS

TXBand	TX-band
OTXBand	Not TX-band
RXBand	RX-band (option FSE-K11 only)
IDLeband	IDLeband (option FSE-K10 only)

This command is a query and therefore not assigned a *RST value. The numeric suffixes <1|2> or <1 to 8> are not significant for this command.

CALCulate<1|2>:LIMit<1 to 8>:MARGin 0 to 100DB

This command sets/changes the value of the margin (safe difference to the actual limit) for the limit check.

Examples:
```
"CALC:LIM:MARG 6DB"
```

Features: *RST value: 3DB
SCPI: device-specific

Modes: BTS, MS

The numeric suffixes <1|2> or <1 to 8> are not significant for this command.

4.1.2 CONFigure Subsystem

The CONFigure subsystem contains commands for configuring complex measurement tasks, like those provided by the option GSM BTS Analyzer (FSE-K11) and GSM MS Analyzer (FSE-K10). The CONFigure subsystem is closely linked to the functions of the FETCH and READ subsystems, where the measurement cycles are started and/or the results of the measurements are queried.

4.1.2.1 CONFigure:BTS Subsystem

This subsystem provides the commands for configuring the GSM BTS Analyzer mode (Option FSE-K11) for analyzing the behavior of base stations corresponding to the standards P-GSM, E-GSM, R-GSM, DCS1800 or PCS1900.

COMMAND	PARAMETERS	UNIT	COMMENT
CONFigure			
[:BTS]			Option FSE-K11
:ARFCn	<numeric_value>	--	
:AUTO	ONCE		no query
:LIMit			
:PPEak	<numeric_value>	DEG	
:PRMS	<numeric_value>	DEG	
:FREQuency	<numeric_value>	PPM	
:STANdard	<Boolean>		
:POWer			
:CLASs	<numeric_value> | M1 | M2 | M3	--	
:COUPled	<Boolean>		
:STATic	<numeric_value>	--	
:DYNamic	<numeric_value>	--	
:EXPected	<numeric_value>	DBM	
:LIMit	<numeric_value>	DBM	
:SINGle			
[:STATe]	<Boolean>		
:CLEar	--		no query
:CHANnel			
:SLOT	<numeric_value>	--	
:AUTO	ONCE		no query
:TSC	<numeric_value>	--	
:AUTO	<Boolean>		
:SFH	<Boolean>		
:NETWork			
[:TYPE]	PGSM | PGSM900| EGSM | EGSM900 | DCS | GSM1800 | PCS | GSM1900 | RGSM | RGSM900		
:PHASe	1|2[,PLUS]		
:COSiting	<Boolean>		
:TXSupp	<Boolean>		
:PRESet	--		
:SWEeptime	STANdard | AUTO		

CONFigure[:BTS]:ARFCn <numeric_value>

This command selects the number of the transmission channel of the base station.

Parameter: <numeric_value>::= 1 to 124 (P-GSM phase I/II)
0 to 124, 975 to 1023 (E-GSM)
0 to 124, 955 to 1023 (R-GSM)
512 to 885 (DCS1800 phase I/II/II+)
512 to 810 (PCS1900)

Example: "CONF:ARFC 67"

Features: *RST value: 1 (P-GSM phase I/II)
0 (E-GSM, R-GSM)
512 (DCS1800 phase I/II/II+)
512 (PCS1900)
SCPI: device-specific

Mode: BTS

CONFigure[:BTS]:ARFCn:AUTO ONCE

This command is used to search for the channel number of the transmission channel of the base station automatically. This requires only one channel to be active.

Example: "CONF:ARFC:AUTO ONCE"

Features: *RST value: --
SCPI: device-specific

Mode: BTS

This command is an event and thus has no query and no *RST value assigned.

CONFigure[:BTS]:LIMit:PPEak <numeric_value>

This command determines the phase error limits in degrees for the phase/frequency measurement (peak value).

Example: "CONF:LIM:PPE 66"

Feature: *RST value: depending on standard
SCPI: device-specific

Mode: BTS

CONFigure[:BTS]:LIMit:PRMS <numeric_value>

This command determines the phase error limits in degrees for the phase/frequency measurement (mean value).

Example: "CONF:LIM:PRMS 22"

Feature: *RST value: depending on standard
SCPI: device-specific

Mode: BTS

CONFigure[:BTS]:LIMit:FREQuency <numeric_value>

This command determines the frequency error limits in ppm for the phase/frequency measurement.

Example: "CONF:LIM:FREQ 36"

Feature: *RST value: depending on standard
SCPI: device-specific

Mode: BTS

CONFigure[:BTS]:LIMit:STANdard ON | OFF

This command switches between user-defined (OFF) and standard-defined (ON) limit values.

Example: "CONF:LIM:STAN ON"

Feature: *RST value: ON
SCPI: device-specific

Mode: BTS

CONFigure[:BTS]:POWer:CLASs <numeric_value> | M1 | M2 | M3

This command defines the power class of the base station.

Parameter: <numeric_value> ::= 1 to 8 (P-GSM phase I/II, E-GSM, R-GSM)
::= 1 to 4 (PCS1900, DCS1800 phase I/II/II+)
M1, M2, M3 ::= Power Classes for Micro BTS

Example: "CONF:POW:CLAS 4"

Features: *RST value: 4 (P-GSM phase I/II, E-GSM, R-GSM)
1 (DCS1800, PCS1900)
SCPI: device-specific

Mode: BTS

CONFigure[:BTS]:POWer:COUPled ON | OFF

This command switches between user-defined (OFF) and standard-defined (ON) level values.

Example: "CONF:POW:COUP ON"

Feature: *RST value: ON
ON standard
OFF user-defined
SCPI: device-specific

Mode: BTS

CONFigure[:BTS]:POWer:STATic 0 to 6

This command defines the static power control level of the base station.

Example: "CONF:POW:STAT 3"

Features: *RST value: 0
SCPI: device-specific

Mode: BTS

CONFigure[:BTS]:POWer:DYNamic 0 to 15

This command defines the dynamic power control level of the base station.

Example: "CONF:POW:DYN 5"

Features: *RST value: 0
SCPI: device-specific

Mode: BTS

CONFigure[:BTS]:POWer:EXPected <numeric_value>

This command enters directly the rated output level of the base station specified by the manufacturer.

Example: "CONF:POW:EXP 43DBM"

Features: *RST value: 46 dBm (P-GSM phase I/II, E-GSM, R-GSM)
43 dBm (DCS1800, PCS1900)
SCPI: device-specific

Mode: BTS

CONFigure[:BTS]:POWer:LIMit <numeric_value>

This command defines the level for the selection of level-dependent limit lines.

Example: "CONF:POW:LIM 65DBM"

Feature: *RST value: depending on standard
SCPI: device-specific

Mode: BTS

This command is only available for the setting CONFigure[:BTS]:POWer:COUPled OFF.

CONFigure[:BTS]:POWer:SINGle[:STATe] ON | OFF

This command switches single measurement of carrier power on and off.

Example: "CONF:POW:SING ON"

Feature: *RST value: OFF
SCPI: device-specific

Mode: BTS

CONFigure[:BTS]:POWer:SINGle:CLEar

This command clears the table containing the single-step carrier power measurements.

Example: "CONF:POW:SING:CLE"

Feature: *RST value: --
SCPI: device-specific

Mode: BTS

This command is an event and has therefore neither *RST value nor query.

CONFigure[:BTS]:CHANnel:SLOT 0 to 7

This command selects the slot number within a transmission frame of the base station.

Example: "CONF:CHAN:SLOT 3"

Features: *RST value: 0
SCPI: device-specific

Mode: BTS

On changing the slot number, the number of the midamble (TSC) is automatically adapted to the slot.

CONFigure[:BTS]:CHANnel:SLOT:AUTO ONCE

This command automatically searches for the slot number within a transmission frame of the base station. This requires only one slot to be active.

Example: "CONF:CHAN:SLOT:AUTO ONCE"

Features: *RST value: --
SCPI: device-specific

Mode: BTS

This command is an event and thus has no query and no *RST value assigned.

CONFigure[:BTS]:CHANnel:SFH ON | OFF

This command defines whether the base station uses slow frequency hopping or not.

Example: "CONF:CHAN:SFH ON"

Features: *RST value: OFF
SCPI: device-specific

Mode: BTS

This command is available only when spurious or transient spectrum measurement is selected. The settings for spurious measurement are independent from those selected for transient spectrum.

CONFigure[:BTS]:CHANnel:TSC:AUTO ON | OFF

This command couples the midamble (training sequence TSC_0 to 7) to the slot, i.e. if the slot number is changed the training sequence in the ON state is automatically adapted. In the OFF state, the training sequence set is conserved even if the slot number is changed.

Example: "CONF:CHAN:TSC:AUTO ON"

Features: *RST value: ON
SCPI: device-specific

Mode: BTS

CONFigure[:BTS]:CHANnel:TSC 0 to 7

This command selects the midamble (training sequence TSC_0 to 7) of the active slot.

Example: "CONF:CHAN:TSC 3"

Features: *RST value: 0
SCPI: device-specific

Mode: BTS

CONFigure[:BTS]:NETWork[:TYPE] PGSM | PGSM900 | EGSM |EGSM900 | DCS |GSM1800 | PCS|GSM1900 | RGSM | RGSM900

This command selects the standard type according to which the base station will work.

Example: "CONF:NETW DCS"

Features: *RST value: GSM
SCPI: device-specific

Mode: BTS

CONFigure[:BTS]:NETWork:PHASe 1|2 [,PLUS]

This command selects the phase of the standard according to which the base station will work.

Example: "CONF:NETW:PHAS 2"

Features: *RST value: 1
SCPI: device-specific

Mode: BTS

CONFigure[:BTS]:COSiting ON | OFF

This command selects whether the base station has the "cositing" feature.

Example: "CONF:COS ON"

Features: *RST value: OFF
SCPI: device-specific

Mode: BTS

This command is available only if spurious emission measurement is selected.

CONFigure[:BTS]:TXSupp ON | OFF

This command defines that an additional carrier suppression of min. 20dB is taken into account for the measurement. If there is already suppression, a more sensitive setting of the instrument is selected.

Example: "CONF:TXS ON"

Features: *RST value: OFF
SCPI: device-specific

Mode: BTS

For measurements in the RX-band the value is automatically set to ON.

CONFigure[:BTS]:PRESet

This command resets the parameters for the standard selected to their default values (DEFAULT SETTINGS).

Example: "CONF:PRES"

Features: *RST value: --
SCPI: device-specific

Mode: BTS

This command is an event and has thus no query and no *RST value assigned.

CONFigure[:BTS]:SWEeptime STANdard | AUTO

This command selects the sweep-time computing mode for the spurious measurement:

Example: "CONF:SWE AUTO"

Feature: *RST value: STANdard
SCPI: device-specific

Mode: BTS

STANdard The computation of the sweep time is based on a worst-case estimation

AUTO The sweep time is reduced by a factor of 8 (assuming all slots are on).

4.1.2.2 CONFigure:BURSt Subsystem

This subsystem provides the commands for configuring the measurements in the GSM BTS Analyzer mode (option FSE-K11) or GSM MS Analyzer mode (option FSE-K10) which are performed on individual bursts. (carrier power, phase/frequency error, power vs. time).

COMMAND	PARAMETERS	UNIT	COMMENT
CONFigure			
:BURSt			
:PFERror			Option FSE-K11&FSE-B7 or FSE-K10&FSE-B7
[:IMMediate]	--	--	no query
:COUNt	<numeric_value>	--	
:POWer			Option FSE-K11 or FSE-K10
[:IMMediate]	--	--	no query
:COUNt	<numeric_value>	--	
:CONDition	NORMal | EXTReme		
:PTEMplate			Option FSE-K11 or FSE-K10
[:IMMediate]	--	--	no query
:COUNt	<numeric_value>	--	
:SELect	FULL | TOP | RISing | FALLing		
:REFerence			Option FSE-K11 or FSE-K10
:AUTO	<Boolean>		

CONFigure:BURSt:PFERror[:IMMediate]

This command selects measurement of the phase and frequency error of the base station or mobile.

Example: "CONF:BURS:PFER"

Features: *RST value: --
SCPI: device-specific

Modes: BTS, MS

This command is an event and thus has no query and no *RST value assigned. It is available only in conjunction with option GSM BTS Analyzer FSE-K11 and Vector Signal Analysis FSE-B7 or in conjunction with option GSM MS Analyzer, FSE-K10, and Vector Signal Analysis, FSE-B7.

CONFigure:BURSt:PFERror:COUNt 1 to 1000

This command sets the number of bursts used for the determination of average and maximum value.

Example: "CONF:BURS:PFER:COUN 100"

Features: *RST value: 500 (GSM/DCS1800 Phase I)
200 otherwise
SCPI: device-specific

Modes: BTS, MS

CONFigure:BURSt:POWer[:IMMediate]

This command selects measurement of the average carrier power of the base station or mobile.

Example: "CONF:BURS:POW"

Features: *RST value: --
SCPI: device-specific

Modes: BTS, MS

This command is an event and thus has no query and no *RST value assigned.

CONFigure:BURSt:POWer:COUNt 1 to 1000

This command sets the number of bursts used for the determination of measured values.

Example: "CONF:BURS:POW:COUN 100"

Features: *RST value: 500 (GSM/DCS1800 phase I)
200 otherwise
SCPI: device-specific

Modes: BTS, MS

CONFigure:BURSt:POWer:CONDition NORMal | EXTReme

This command defines the conditions for power measurement.

Example: "CONF:BURS:POW:COND EXTR"

Features: *RST value: NORMal
SCPI: device-specific

Modes: BTS, MS

CONFigure:BURSt:PTEMplate[:IMMediate]

This command selects measurement of power of the base station or mobile vs. time.

Example: "CONF:BURS:PTEM"

Features: *RST value: --
SCPI: device-specific

Modes: BTS, MS

This command is an event and thus has no query and no *RST value assigned.

CONFigure:BURSt:PTEMPlate:COUNt 1 to 1000

This command defines the number of bursts used for determining the measured value.

Example: "CONF:BURS:PTEM:COUN 100"

Features: *RST value: 500 (GSM/DCS1800 phase I)
200 otherwise
SCPI: device-specific

Modes: BTS, MS

CONFigure:BURSt:PTEMplate:SELect FULL | TOP | RISing | FALLing

This command defined the burst section to be measured.

Example: "CONF:BURS:PTEM:SEL TOP"

Features: *RST value: FULL
SCPI: device-specific

Modes: BTS, MS

CONFigure:BURSt:REFerence:AUTO ON | OFF

This command switches between automatic and user-activated preview of power versus time. When switched to AUTO, the preview is always performed, when switched to OFF it is omitted. Note: see READ:BURSt:REF:IMM

Example: "CONF:BURS:REF:AUTO ON"

Feature: *RST value: AUTO
SCPI: device-specific

Mode: BTS, MS

4.1.2.3 CONFigure:MS Subsystem

This subsystem provides the commands for configuring the GSM MS Analyzer mode (Option FSE-K10) for analyzing the behavior of mobiles corresponding to the standards P-GSM, E-GSM, R-GSM, DCS1800 or PCS1900.

COMMAND	PARAMETERS	UNIT	COMMENT
CONFigure			
[:MS]			Option FSE-K10
:ARFCn	<numeric_value>	--	
:AUTO	ONCE		no query
:LIMit			
:PPEak	<numeric_value>	DEG	
:PRMS	<numeric_value>	DEG	
:FREQuency	<numeric_value>	PPM	
:STANdard	<Boolean>		
:POWer	<Boolean>		
:CLASs			
:COUPled	<numeric_value>	--	
:LEVel	<numeric_value>	--	
:LIMit	<numeric_value>	DBM	
:EXPected	<numeric_value>	DBM	
:SINGle			
[:STATe]	<Boolean>	--	
:CLEar	--		no query
:SMALl	<Boolean>		
:CHANnel			
:SFH	<Boolean>		
:TSC	<numeric_value>		
:NETWork		--	
[:TYPE]	PGSM | PGSM900| EGSM | EGSM900 | DCS | GSM1800 | PCS | GSM1900 | RGSM | RGSM900		
:PHASe	1 | 2[, PLUS]		
:TXSupp	<Boolean>		
:PRESet	--		
:SWEeptime	STANdard | AUTO		

CONFigure[:MS]:ARFCn <numeric_value>

This command selects the number of the transmission channel of the mobile.

Parameter: <numeric_value>::=

1 to 124	(P-GSM phase I/II)
0 to 124, 975 to 1023	(E-GSM)
0 to 124, 955 to 1023	(R-GSM)
512 to 885	(DCS1800 phase I/II/II+)
512 to 810	(PCS1900)

Example: "CONF:ARFC 67"

Features: *RST value:

1	(P-GSM phase I/II)
0	(E-GSM, R-GSM)
512	(DCS1800 phase I/II/II+)
512	(PCS1900)

SCPI: device-specific

Mode: MS

CONFigure[:MS]:ARFCn:AUTO ONCE

This command selects automatically the transmission channel of the mobile.

Example: "CONF:ARFC:AUTO ONCE"

Features: *RST value: -
SCPI: device-specific

Mode: MS

CONFigure[:MS]:LIMit:PPEak <numeric_value>

This command determines the phase error limits in degrees for the phase/frequency measurement (peak value).

Example: "CONF:LIM:PPE 66"

Feature: *RST value: depending on standard
SCPI: device-specific

Mode: MS

CONFigure[:MS]:LIMit:PRMS <numeric_value>

This command determines the phase error limits in degrees for the phase/frequency measurement (mean value).

Example: "CONF:LIM:PRMS 22"

Feature: *RST value: depending on standard
SCPI: device-specific

Mode: MS

CONFigure[:MS]:LIMit:FREQuency <numeric_value>

This command determines the frequency error limits in ppm for the phase/frequency measurement.

Example: "CONF:LIM:FREQ 36"

Feature: *RST value: depending on standard
SCPI: device-specific

Mode: MS

CONFigure[:MS]:LIMit:STANdard ON | OFF

This command switches between user-defined (OFF) and standard-defined (ON) limit values.

Example: "CONF:LIM:STAN ON"

Feature: *RST value: ON
SCPI: device-specific

Mode: MS

CONFigure[:MS]:POWer:CLASs <numeric_value>

This command defines the power class of the mobile.

Parameter: <numeric_value> ::= 1 to 5 (P-GSM phase I)
2 to 5 (P-GSM phase II)
2 to 5 (E-GSM, R-GSM)
1 to 2 (DCS1800 phase I)
1 to 3 (DCS1800 phase II/II+)
1 to 3 (PCS1900)

Example: "CONF:POW:CLAS 4"

Features: *RST value: 2 (P-GSM phase I/II, E-GSM, R-GSM)
1 (DCS1800, PCS1900)
SCPI: device-specific

Mode: MS

CONFigure[:MS]:POWer:COUPled ON | OFF

This command switches between user-defined (OFF) and standard-defined (ON) level values.

Example: "CONF:POW:COUP ON"

Feature: *RST value: ON
ON standard
OFF user-defined
SCPI: device-specific

Mode: MS

CONFigure[:MS]:POWer:LEVel 0 to 31

This command defines the power control level of the mobile.

Example: "CONF:POW:LEV 5"

Features: *RST value: 2 (P-GSM Phase I/II, E-GSM, R-GSM)
0 (DCS1800, PCS1900)
SCPI: device-specific

Mode: MS

CONFigure[:MS]:POWer:LIMit <numeric_value>

This command defines the level for the selection of level-dependent limit lines.

Example: "CONF:POW:LIM 65DBM"

Feature: *RST value: depending on standard
SCPI: device-specific

Mode: MS

This command is only available for the setting CONFigure[:MS]:POWer:COUPled OFF.

CONFigure[:MS]:POWer:EXPected <numeric_value>

This command enters directly the rated output level of the mobile.

Example: "CONF:POW:EXP 43DBM"

Features: *RST value: 46 dBm (P-GSM phase I/II, E-GSM, R-GSM)
43 dBm (DCS1800, PCS1900)
SCPI: device-specific

Mode: MS

CONFigure[:MS]:POWer:SINGle[:STATe] ON | OFF

This command switches single measurement of carrier power on and off.

Example: "CONF:POW:SING ON"

Feature: *RST value: OFF
SCPI: device-specific

Mode: MS

CONFigure[:MS]:POWer:SINGle:CLEar

This command clears the table containing the single-step carrier power measurements.

Example: "CONF:POW:SING:CLE"

Feature: *RST value: --
SCPI: device-specific

Mode: MS

This command is an event and has therefore neither *RST value nor query.

CONFigure[:MS]:POWer:SMALl ON | OFF

This command switches the limits for spurious measurement in the RGSM range. The command is available only for Phase II+.

Example: "CONF:POW:SMAL ON"

Feature: *RST value: OFF
SCPI: device-specific

Mode: MS

CONFigure[:MS]:CHANnel:SFH ON | OFF

This command switches slow-frequency hopping on or off.

Example: "CONF:CHAN:SFH ON"

Feature: *RST value: OFF
SCPI: device-specific

Mode: MS

CONFigure[:MS]:CHANnel:TSC 0 to 7

This command selects the midamble used by the mobile.

Parameter: 0 to 7 (training sequence for the Normal Burst)

Example: "CONF:CHAN:TSC 3"

Features: *RST value: 0
SCPI: device-specific

Mode: MS

CONFigure[:MS]:NETWork[:TYPE] PGSM | PGSM900 | EGSM | EGSM900 | DCS | GSM1800 | PCS | GSM1900 | RGSM | RGSM900

This command selects the standard type according to which the mobile will work.

Example: "CONF:NETW DCS"

Features: *RST value: GSM
SCPI: device-specific

Mode: MS

CONFigure[:MS]:NETWork:PHASe 1 | 2 [,PLUS]

This command selects the phase of the standard according to which the mobile will work.

Example: "CONF:NETW:PHAS 2"

Features: *RST value: 1
SCPI: device-specific

Mode: MS

CONFigure[:MS]:TXSupp ON | OFF

This command defines that an additional carrier suppression of min. 20dB is taken into account for the measurement. If there is already suppression, a more sensitive setting of the instrument is selected.

Example: "CONF:TXS ON"

Features: *RST value: OFF
SCPI: device-specific

Mode: MS

For measurements in the RX-band the value is automatically set to ON.

CONFigure[:MS]:PRESet

This command resets the parameters for the standard selected to their default values (DEFAULT SETTINGS).

Example: "CONF:PRES"

Features: *RST value: --
SCPI: device-specific

Mode: MS

This command is an event and has thus no query and no *RST value assigned.

CONFigure[:MS]:SWEeptime STANdard | AUTO

This command selects the sweep-time computing mode for the spurious measurement:

Example: "CONF:SWE:STAN AUTO"

Feature: *RST value: STANdard
SCPI: device-specific

Mode: MS

STANdard The computation of the sweep time is based on a worst-case estimation

AUTO The sweep time is reduced by a factor of 8 (assuming all slots are on).

4.1.2.4 CONFigure:SPECtrum Subsystem

This subsystem provides the commands for configuring the measurements in the GSM BTS Analyzer mode (FSE-K11) or in the GSM MS Analyzer mode (FSE-K10) used to determine the power of the spectral contributions due to modulation and switching (modulation spectrum, transient spectrum).

COMMAND	PARAMETERS	UNIT	COMMENT
CONFigure			
:SPECtrum			
:MODulation			
[:IMMediate]	--	--	Option FSE-K11 or FSE-K10, no query
:COUNt	<numeric_value>	--	Option FSE-K11 or FSE-K10
:RANGe	ARFCn | TXBand | RXBand | COMBined | DCSRx1800		Option FSE-K11 or FSE-K10
:TGATe	<Boolean>		Option FSE-K11
:SWITching			Option FSE-K11 or FSE-K10, no query
[:IMMediate]	--	--	
:COUNt	<numeric_value>	--	

CONFigure:SPECtrum:MODulation[:IMMediate]

This command selects measurement of the spectrum due to modulation.

Example: "CONF:SPEC:MOD"

Features: *RST value: --
SCPI: device-specific

Modes: BTS, MS

This command is an event and has thus no query and no *RST value assigned.

CONFigure:SPECtrum:MODulation:COUNt 1 to 1000

This command sets the number of bursts used for determining the average and maximum values.

Example: "CONF:SPEC:MOD:COUN 100"

Features: *RST value: 500 (GSM/DCS1800 phase I)
200 otherwise
SCPI: device-specific

Modes: BTS, MS

CONFigure:SPECtrum:MODulation:RANGe ARFCn | TXBand | RXBand | COMBined | DCSRx1800

This command selects the frequency range for the measurement.

Example: "CONF:SPEC:MOD:RANG TXB"

Features: *RST value: ARFCn
SCPI: device-specific

Modes: BTS, MS

ARFCn	ARFCN ± 1.8 MHz	COMBined	ARFCN ± 1.8 MHz / TX-band
TXBand	TX-band	DCSRx1800	RX-Band DCS 1800 (option FSE-K10 only)
RXBand	RX-band		

CONFigure:SPECtrum:SWITching[:IMMediate]

This command selects measurement of the spectrum due to switching transients.

Example: "CONF:SPEC:SWIT "

Features: *RST value: --
SCPI: device-specific

Modes: BTS, MS

This command is an event and has thus no query and no *RST value assigned.

CONFigure:SPECtrum:MODulation:TGATe ON | OFF

This command switches gating in the TX band on or off.
If gating is switched off, all 8 slots should be active.

Example: "CONF:SPEC:MOD:TGAT ON"

Features: *RST value: OFF
SCPI: device-specific

Mode: BTS

CONFigure:SPECtrum:SWITching:COUNt 1 to 1000

This command defines the number of bursts used for determining the average and maximum values.

Example: "CONF:SPEC:SWIT:COUN 100"

Features: *RST value: 500 (GSM/DCS1800 phase I)
200 otherwise
SCPI: device-specific

Modes: BTS, MS

4.1.2.5 CONFigure:SPURious Subsystem

This subsystem provides commands for configuring the measurements in the GSM BTS (FSE-K11) or GSM MS (FSE-K10) Analyzer mode used for measuring the power of spurious emissions.

COMMAND	PARAMETERS	UNIT	COMMENT
CONFigure			
:SPURious			
[:IMMediate]	--	--	Option FSE-K11, FSE-K10
:COUNt	<numeric_value>	--	Option FSE-K11, FSE-K10
:RXBand	<numeric_value>	--	Option FSE-K11
:RANGe	TXBand | OTXBand | RXBand | IDLeband | COMBined	--	Option FSE-K11, FSE-K10
:STEP<1..26>	<Boolean>	--	Option FSE-K11, FSE-K10
:COUNt?			query only
:ANTenna	CONDucted | RADiated		Option FSE-K10

CONFigure:SPURious[:IMMediate]

This command selects measurement of spurious emissions.

Example: "CONF:SPUR"

Features: *RST value: --
SCPI: device-specific

Modes: BTS, MS

This command is an event and has thus no query and no *RST value assigned.

CONFigure:SPURious:COUNt 1 to 1000

This command sets the number of bursts used for determining the average and maximum values.

Example: "CONF:SPUR:COUN 100"

Features: *RST value: 500 (GSM/DCS1800 phase I)
200 otherwise
SCPI: device-specific

Modes: BTS, MS

The number of bursts in measurements of the RX band is set by command CONFigure:SPURious :RANGe:RXBand (FSE K11 only).

CONFigure:SPURious:COUNt:RXBand 1 to 1000

This command sets the number of bursts used for determining the average and maximum values in measurements of the RX band.

Example: "CONF:SPUR:COUN:RXB 100"

Features: *RST value: 1
SCPI: device-specific

Modes: BTS

CONFigure:SPURious:RANGe TXBand | OTXBand | RXBand | IDLeband | COMBined

This command selects the frequency range used for the measurement.

Example: "CONF:SPUR:RANG OTX"

Features: *RST value: TXB
SCPI: device-specific

Modes: BTS, MS

TXBand	TX-Band
OTXBand	Not TX-Band
RXBand	RX-Band (option FSE-K11 only)
IDLeband	Idle band (option FSE-K10 only)
COMBined	TX-Band ± 2 MHz (option FSE-K11 only)

CONFigure:SPURious:STEP<1...26> ON | OFF

This command selects a subband of the selected band for a spurious measurement.

Each band is divided up into 1 to max. 26 subbands, which are selected by the numerical suffix following STEP. A subband is selected for measurement by setting ON.

Example: "CONF:SPUR:STEP24 ON"

Feature: *RST value: ON
SCPI: device-specific

Mode: BTS, MS

CONFigure:SPURious:ANTenna CONDucted | RADiated

This command selects the features of the measurement of spurious emissions.

Example: "CONF:SPUR:ANT RAD"

Feature: *RST value: COND
SCPI: device-specific

Mode: MS

4.1.3 FETCh Subsystem

The FETCh subsystem contains commands for reading out results of complex measurement tasks like those provided by options GSM BTS Analyzer, FSE-K11, or GSM MS Analyzer, FSE-K10. The FETCh-subsystem is closely linked to the functions of the CONFigure and READ-subsystems, where the measurement sequences are configured, the measurements are started and their results are queried.

4.1.3.1 FETCh:BURSt Subsystem

This subsystem provides the commands for reading out results of measurements in the GSM BTS (option FSE-K11) or GSM MS (option FSE-K10) Analyzer mode, which are performed on individual bursts (Carrier Power, Phase/Frequency Error) without starting the measurement by themselves.

COMMAND	PARAMETERS	UNIT	COMMENT
FETCh			Option FSE-K11 or FSE-K10
:BURSt			
:PERRor			
:RMS			
:STATus?			query only
:AVERage?	--		query only
:MAXimum?	--		query only
:PEAK			
:STATus?			query only
:AVERage?	--		query only
:MAXimum?	--		query only
:FERRor			
:STATus?			query only
:AVERage?	--		query only
:MAXimum?	--		query only
:POWer	--		
[:IMMediate]?	--		query only
:ALL?	--		query only

FETCh:BURSt:PERRor:RMS:STATus?

This command reads out the status of the RMS-measurement of the phase error taken over the selected number of bursts.

0: failed, 1: passed

Example: "FETC:BURS:PERR:RMS:STAT?"

Features: *RST value: --
SCPI: device-specific

Modes: BTS, MS

If no measurement has been performed yet, a query error results. This command is a query and has therefore no *RST value assigned.
It is available only when measurement of the phase/frequency error is selected (see CONFigure:BURSt:PFERror).

FETCh:BURSt:PERRor:RMS:AVERage?

This command reads out the average of the RMS-measurement of the phase error taken over the selected number of bursts.

Example: "FETC:BURS:PERR:RMS:AVER?"

Features: *RST value: --
SCPI: device-specific

Modes: BTS, MS

If no measurement has been performed yet, a query error results. This command is a query and has therefore no *RST value assigned.
It is available only when measurement of the phase/frequency error is selected (see CONFigure:BURSt:PFERror).

FETCh:BURSt:PERRor:RMS:MAXimum?

This command reads out the maximum of the RMS-measurement of the phase error for the selected number of bursts.

Example: "FETC:BURS:PERR:RMS:MAX?"

Features: *RST value: --
SCPI: device-specific

Modes: BTS, MS

If no measurement has been performed yet, a query error results.
This command is a query only and therefore has no *RST value assigned. It is available only when measurement of the phase/frequency error is selected (see CONFigure:BURSt:PFERror).

FETCh:BURSt:PERRor:PEAK:STATus?

This command reads out the status of the peak measurement of the phase error taken over the selected number of bursts.

0: failed, 1: passed

Example: "FETC:BURS:PERR:PEAK:STAT?"

Features: *RST value --
SCPI: device-specific

Modes: BTS, MS

If no measurement has been performed yet, a query error results.
This command is a query only and therefore has no *RST value assigned. It is available only if measurement of the phase/frequency error is selected (see CONFigure:BURSt:PFERror).

FETCh:BURSt:PERRor:PEAK:AVERage?

This command reads out the average of the peak measurement of the phase error taken over the selected number of bursts.

Example: "FETC:BURS:PERR:PEAK:AVER?"

Features: *RST value: --
SCPI: device-specific

Modes: BTS, MS

If no measurement has been performed yet, a query error results.
This command is a query only and therefore has no *RST value assigned. It is available only if measurement of the phase/frequency error is selected (see CONFigure:BURSt:PFERror).

FETCh:BURSt:PERRor:PEAK:MAXimum?

This command reads out the maximum of the peak measurement of the phase error for the selected number of bursts.

Example: "FETC:BURS:PERR:PEAK:MAX?"

Features: *RST value: --
SCPI: device-specific

Modes: BTS, MS

If no measurement has been performed yet, a query error results.
This command is a query only and therefore has no *RST value assigned. It is available only when measurement of the phase/frequency error is selected (see CONFigure:BURSt:PFERror).

FETCh:BURSt:FERRor:STATus?

This command reads out the status of the measurement of the frequency error taken over the selected number of bursts.

0: failed, 1: passed

Example: "FETC:BURS:FERR:STAT?"

Features: *RST value: --
SCPI: device specific

Modes: BTS, MS

If no measurement has been performed yet, a query error results.
This command is a query only and therefore has no *RST value assigned. It is available only if measurement of the phase/frequency error is selected (see CONFigure:BURSt:PFERror).

FETCh:BURSt:FERRor:AVERage?

This command reads out the average of the measurement of the frequency error taken over the selected number of bursts.

Example: "FETC:BURS:FERR:AVER?"

Features: *RST value: --
SCPI: device-specific

Modes: BTS, MS

If no measurement has been performed yet, a query error results.
This command is a query only and therefore has no *RST value assigned. It is available only if measurement of the phase/frequency error is selected (see CONFigure:BURSt:PFERror).

FETCh:BURSt:FERRor:MAXimum?

This command reads out the maximum frequency error measured over the selected number of bursts.

Example: "FETC:BURS:FERR:MAX?"

Features: *RST value: --
SCPI: device-specific

Modes: BTS, MS

If no measurement has been performed yet, a query error results.
This command is a query only and therefore has no *RST value assigned. It is available only if measurement of the phase/frequency error is selected (see CONFigure:BURSt:PFERror).

FETCh:BURSt:POWer[:IMMediate]?

This command reads out the result of the last step performed during the measurement of the output power of the base station or mobile.

Parameter: The result is output as an ASCII string in the following format:

<Static Power Ctrl>,<Dyn Power Ctrl>,<Rat-Level>,<Act-Level>, <Delta>,<Status>

with

<Static Power Ctrl>:	current static power control level
<Dyn Power Ctrl>:	current dynamic power control level
<Rat-Level>:	Rated value for the current power control level acc. to standard dBm
<Act-Level>:	measured power in dBm
<Delta>:	Difference between the measured power and the power at the previous static/dynamic power control level.
<Status>:	Result of limit check in character data form: PASSED no limits exceeded FAILED limit exceeded

Example: "FETC:BURS:POW?"
Result: 0,0,43,44.1,0,PASSED

Features: *RST value: --
SCPI: device-specific

Modes: BTS, MS

If no measurement has been performed yet, a query error results.
This command is a query only and therefore has no *RST value assigned. It is available only if measurement of the phase/frequency error is selected (see CONFigure:BURSt:PFERror).

FETCh:BURSt:POWer:ALL?

This command reads out the results of all individual steps during the measurement of the output power of the base station or mobile.

Parameter: The result is output as an ASCII string in the following format:

<Static Power Ctrl>,<Dyn Power Ctrl>,<Rat-Level>,<Act-Level>, <Delta>,<Status>

with

<Static Power Ctrl>:	current static power control level
<Dyn Power Ctrl>:	current dynamic power control level
<Rat-Level>:	Rated value for the current power control level acc. to standard dBm
<Act-Level>:	measured power in dBm
<Delta>:	Difference between the measured power and the power at the previous static/dynamic power control level.
<Status>:	Result of limit check in character data form: PASSED no limits exceeded FAILED limit exceeded

Example: "FETC:BURS:POW:ALL?"
Result:
0,0,43,44.1,0,PASSED,1,0,41,42.5,1.6,PASSED,1,1,35,32.5,5.6,FAILED

Features: *RST value: --
SCPI: device-specific

Modes: BTS, MS

If no measurement has been performed yet, a query error results.
This command is a query only and therefore has no *RST value assigned. It is available only if measurement of the phase/frequency error is selected (see CONFigure:BURSt:PFERror).

4.1.3.2 FETCh:SPECtrum Subsystem

This subsystem provides the commands for reading out results of measurements in the GSM BTS (FSE-K11) or GSM MS (FSE-K10) Analyzer mode, used to measure the power of the spectral contributions due to modulation and switching (modulation spectrum, transient spectrum) without first restarting a new measurement.

COMMAND	PARAMETERS	UNIT	COMMENT
FETCh			Option FSE-K11 or FSE-K10
:SPECtrum			
:MODulation			
[:ALL]?	ARFCn | TXBand | RXBand | COMBined | DCSRx1800		
:REFerence?			query only
:SWITching			
[:ALL]?	--		query only
:REFerence?			query only

FETCh:SPECtrum:MODulation[:ALL]? ARFCn | TXBand | RXBand | COMBined | DCSRx1800

This command reads out the result of the measurement of the modulation spectrum of the base station or mobile.

Parameter: The result is output as a list of partial result strings separated by ',' in the following (ASCII) format:

<Index>,<Freq1>,<Freq2>,<Level>,<Limit>, <Abs/Rel>,<Status> [,
<Index>,<Freq1>,<Freq2>,<Level>,<Limit>, <Abs/Rel>,<Status>]...

where the parts between '[...]' denote a partial result string that can be repeated n times.

<Index>: 0, if the partial result string characterizes a measurement range
current number <>0,
if the partial result string characterizes a single limit excess.

<Freq1>: Start frequency of the measurement range or frequency where the limit line is exceeded

<Freq2>: Start frequency of the measurement range or frequency exceeding the measurement range. The value of <Freq2> is equal to the value of <Freq1>, if either the measurement is performed in the time domain or if the partial result string contains a limit excess.

<Level>: Measured maximum level of the partial range or measured level at the test point.

<Limit>: Limit in the partial range or at the test point

<Abs/Rel>: ABS <Level> and <Limit> are in absolute units (dBm)
REL <Level> and <Limit> are in absolute units (dBm)

<Status>: Result of the limit check in character data form:
PASSED no limit exceeded
FAILED limit exceeded
MARGIN margin exceeded
EXC limit excess marked as an exception

The frequencies <Freq1> and <Freq2> are always absolute i. e. not referred to the carrier frequency.

Example: "FETC:SPEC:MOD? TXB"
Result: 0,890E6,915E6,-87.4,-108.0,ABS,FAILED,
1,893.2E6,893.2E6,-83.2,-108.0,ABS,FAILED,
2,895.7E6,895.7E6,-87.4,-108.0,ABS,FAILED

Features: *RST value: --
SCPI: device-specific

Modes: BTS, MS

ARFCn	ARFCN ± 1.8 MHz
TXBand	TX-Band
RXBand	RX-Band
COMBined	ARFCN ± 1.8 MHz / TX-Band (option FSE-K11 only)
DCSRx1800	RX band DCS 1800 (option FSE-K10 only)

If no measurement has been performed yet, a query error results.
This command is a query only and therefore has no *RST value assigned. It is available only if measurement of the modulation spectrum is selected (see CONFigure:SPECtrum:MODulation).

FETCh:SPECtrum:MODulation:REFerence?

This command reads out the result of the premeasurement.

Parameter: The result is output as a list of partial result strings separated by ',' in the following (ASCII) format:
<Level1>,<Level2>,<RBW>
<Level1>: measured level
<Level2>: level corrected by means of the bandwidth
<RBW>: bandwidth

Example: "FETC:SPEC:MOD:REF?"
Result: 36.2,43.2,30000

Features: *RST value: --
SCPI: device-specific

Modes: BTS, MS

If no measurement has been performed yet, a query error results.
This command is a query only and therefore has no *RST value assigned. It is available only if measurement of the modulation spectrum is selected (see CONFigure:SPECtrum:MODulation).

FETCh:SPECtrum:SWITching[:ALL]?

This command reads out the result of the measurement of the transient spectrum of the base station or mobile.

Parameter: The result is output as a list of partial result strings separated by ',' as for the command `FETCh:SPECtrum:MODulation[:ALL]?`.

Example: `"FETC:SPEC:SWIT?"`

Result:
```
0,833.4E6,833.4E6,37.4,-36.0,ABS,MARGIN,
1,834.0E6,834.0E6,-35.2,-36.0,ABS,FAILED,
2,834.6E6,834.6E6,-74.3,-75.0,REL,FAILED
0,835.0E6,835.0E6,-65,0,-60.0,REL,PASSED
```

Features: *RST value: --
SCPI: device-specific

Modes: BTS, MS

If no measurement has been performed yet, a query error results.
This command is a query only and therefore has no *RST value assigned. It is available only if measurement of the transient spectrum is selected (see `CONFigure:SPECtrum:SWITching`).

FETCh:SPECtrum:SWITching:REFerence?

This command queries the result of the premeasurement

Parameter: The result is output as a list of partial result strings separated by ',' in the following (ASCII) format:

<Level1>,<Level2>,<RBW>

<Level1>: measured level

<Level2>: level corrected by means of the bandwidth

<RBW>: bandwidth

Example: `"FETC:SPEC:SWIT:REF?"`

Result: 43.2,43.2,300000

Features: *RST value --
SCPI: device specific

Modes: BTS, MS

If no measurement has been performed yet, a query error results.
This command is a query only and therefore has no *RST value assigned. It is available only if measurement of the transient spectrum is selected (see `CONFigure:SPECtrum:SWITching`).

4.1.3.3 FETCh:SPURious Subsystem

This subsystem provides the commands for reading out results of measurements in the GSM BTS (FSE-K11) or GSM MS (FSE-K10) Analyzer mode which are used to determine spurious emissions, without first restarting a new measurement.

COMMAND	PARAMETERS	UNIT	COMMENT
FETCh			Option FSE-K11 or FSE-K10
:SPURious			
[:ALL]?	TXBand | OTXBand | RXBand | IDLeband		query only
:STEP?	--1)		query only

FETCh:SPURious[:ALL]? TXBand | OTXBand | RXBand | IDLeband

This command reads out the results of the measurement of spurious emissions of the base station or mobile which is performed in the LIST mode.

Parameter: The result is output as a list of partial result strings separated by ',' in the following (ASCII) format:

<Index>,<Freq1>,<Freq2>,<Level>,<Limit>, <Abs/Rel>,<Status> [,
<Index>,<Freq1>,<Freq2>,<Level>,<Limit>, <Abs/Rel>,<Status>]...

where the parts between '[...]' denote a partial result string that can be repeated n times.

<Index>: 0, if the partial result string characterizes a measurement range
current number <>0,
if the partial result string characterizes a single limit excess.

<Freq1>: Start frequency of the measurement range or frequency where the limit line is exceeded

<Freq2>: Start frequency of the measurement range or frequency exceeding the measurement range. The value of <Freq2> is equal to the value of <Freq1>, if either the measurement is performed in the time domain or if the partial result string contains a limit excess.

<Level>: Measured maximum level of the partial range or measured level at the test point.

<Limit>: Limit in the partial range or at the test point

<Abs/Rel>: ABS <Level> and <Limit> are in absolute units (dBm)
REL <Level> and <Limit> are in absolute units (dBm)

<Status>: Result of the limit check in character data form:
PASSED no limit exceeded
FAILED limit exceeded
MARGIN margin exceeded

Example: "FETC:SPUR? TXB"
Result: 0,890E6,915E6,-87.4,-108.0,ABS,FAILED,
1,893.2E6,893.2E6,-83.2,-108.0,ABS,FAILED,
2,895.7E6,895.7E6,-87.4,-108.0,ABS,FAILED

Features: *RST value: --
SCPI: device-specific

Modes: BTS, MS

TXBand	TX-band	RXBand	RX-band (option FSE-K11 only)
OTXBand	Not TX-band	IDLeband	Idle band (option FSE-K10 only)

If no measurement has been performed yet, a query error results.

This command is a query only and therefore has no *RST value assigned. It is available only if measurement of the spurious emissions is selected (see CONFigure:SPURious).

FETCh:SPURious:STEP?

This command reads out the result of the last single step of the measurement of spurious emissions performed in the STEP mode.

Parameter: The result is output as a list of partial result strings separated by ',' as for the command `FETCh:SPURious[:ALL]?`.

Example: `"FETC:SPUR:STEP?"`

Result:
```
0,890E6,915E6,-87.4,-108.0,ABS,FAILED,
1,893.2E6,893.2E6,-83.2,-108.0,ABS,FAILED,
2,895.7E6,895.7E6,-87.4,-108.0,ABS,FAILED
```

Features: *RST value: --
SCPI: device-specific

Modes: BTS, MS

If no measurement has been performed yet, a query error results.
This command is a query only and therefore has no *RST value assigned. It is available only if measurement of the spurious emissions is selected (see `CONFigure:SPURious`).

4.1.3.4 FETCh:PTEMplate Subsystem

This subsystem provides the commands for reading out results of measurements in the GSM BTS (FSE-K11) or GSM MS (FSE-K10) Analyzer mode which are used to determine the carrier power of , power versus time measurement without first restarting a new measurement.

COMMAND	PARAMETER	UNIT	COMMENT
FETCh :PTEMplate :REFerence?			Option FSE-K11, FSE-K10 query only

FETCh:PTEMplate:REFerence?

This command reads out the results of the premeasurement

Parameter: The result is output as a list of partial result strings separated by ',' in the following (ASCII) format:

<Level1>,<Level2>,<RBW>

<Level1>: measured level

<Level2>: level corrected by means of the bandwidth

<RBW>: bandwidth

Example: "FETC:PTEM:REF?"
Result: 43.2,43.2,1000000

Features: *RST value: --
SCPI: device-specific

Modes: BTS, MS

If no measurement has been performed yet, a query error results.
This command is a query only and therefore has no *RST value assigned. It is available only if measurement of Power versus Time is selected (see CONFigure:BURSt:PTEMplate).

4.1.4 INSTrument Subsystem

The INSTrument subsystem selects the operating mode of the unit either via text parameters or fixed numbers. In the split-screen representation, a distinction is made between INSTrument1 (screen A) and INSTrument2 (screen B).

COMMAND	PARAMETERS	UNIT	COMMENT
INSTrument<1|2>			
[:SELect]	SANalyzer | DDEMod | ADEMod | BSGM | MGSM		Vector Signal Analysis FSE-K11 or FSE-K10,
:NSELect	<numeric_value>		

INSTrument<1|2>[:SELect] SANalyzer | DDEMod | ADEMod | BGSM | MSGM

This command switches between the operating modes by means of text parameters.

Parameter:
SANalyzer: spectrum analysis
DDEMod: vector signal analysis, digital demodulation
ADEMod: vector signal analysis, analog demodulation
BGSM: GSM BTS analysis
MGSM: GSM MS analysis

Example: `"INST DDEM"`

Features:
*RST value: SANalyzer
SCPI: conforming

Modes: A, VA, BTS, MS

Switchover to BGSM is only possible in conjunction with option FSE-K11, GSM BTS Analyzer
Switchover to MGSM is only possible in conjunction with option FSE-K10, GSM MS Analyzer

INSTrument<1|2>:NSELect 1 to 5

This command switches between the two modes by means of numbers.

Parameter:
1: spectrum analysis
2: vector signal analysis, digital demodulation
3: vector signal analysis, analog demodulation
4: GSM BTS analysis
5: GSM MS analysis

Example: `"INST:NSEL 2"`

Features:
*RST value: 1
SCPI: conforming

Modes: A, VA, BTS, MS

Switchover to 4 is only possible in conjunction with option FSE-K11, GSM BTS Analyzer
Switchover to 5 is only possible in conjunction with option FSE-K10, GSM MS Analyzer

4.1.5 READ Subsystem

The READ-subsystem contains commands for starting complex measurement tasks such as those provided by options GSM BTS Analyzer (FSE-K11) or GSM MS Analyzer (FSE-K10), and for querying the results subsequently. The READ-subsystem is closely linked to the functions of the CONFigure- and FETCh-subsystems, where the measurement sequences are configured or the results are queried without restarting a new measurement.

4.1.5.1 READ:BURSt Subsystem

This subsystem provides the commands for starting measurements in the GSM BTS Analyzer mode (option FSE-K11), which are performed on individual bursts (carrier power, phase/frequency error), and for reading out the results subsequently.

COMMAND	PARAMETERS	UNIT	COMMENT
READ			
:BURSt			Option FSE-K11 or FSE-K10
:PERRor			
:RMS			query only
:STATus?			query only
:AVERage?	--		query only
:MAXimum?	--		
:PEAK			query only
:STATus?			query only
:AVERage?	--		query only
:MAXimum?	--		
:FERRor			query only
:STATus?			query only
:AVERage?	--		query only
:MAXimum?	--		
:POWer?	--		query only; FSE-K11 only
:STATic?	--		query only; FSE-K11 only
:DYNamic?	--		query only; FSE-K10 only
:LEVel?	--		query only
:REFerence			
[:IMMediate?]	--		query only

READ:BURSt:PERRor:RMS:STATus?

This command starts the measurement of the phase and frequency error of the base station or mobile and reads out the status of the RMS-measurement of the phase error taken over the selected number of bursts.

0: failed, 1: passed

Example: "READ:BURS:PERR:RMS:STAT?"

Features: *RST value: --
SCPI: device-specific

Modes: BTS, MS

When the measurement is started the instrument automatically assumes the SINGLE mode.

An ongoing measurement can be aborted via the command ABORt. Further results of the phase/frequency error measurement can be then queried without restart of the measurement via the FETCh:BURSt-subsystem.

This command is a query only and therefore has no *RST value assigned. It is available only if measurement of the phase/frequency error is selected (see CONFigure:BURSt:PFERror).

READ:BURSt:PERRor:RMS:AVERage?

This command starts the measurement of the phase and frequency error of the base station or mobile and reads out the average of the RMS-measurement of the phase error taken over the selected number of bursts.

Example: "READ:BURS:PERR:RMS:AVER?"

Features: *RST value: --
SCPI: device-specific

Modes: BTS, MS

When the measurement is started the instrument automatically assumes the SINGLE mode.

An ongoing measurement can be aborted via the command ABORt. Further results of the phase/frequency error measurement can be then queried without restart of the measurement via the FETCh:BURSt-subsystem.

This command is a query only and therefore has no *RST value assigned. It is available only if measurement of the phase/frequency error is selected (see CONFigure:BURSt:PFERror).

READ:BURSt:PERRor:RMS:MAXimum?

This command starts the measurement of the phase and frequency error of the base station or mobile and reads out the maximum of the RMS-measurement of the phase error for the selected number of bursts.

Example: "READ:BURS:PERR:RMS:MAX?"

Features: *RST value: --
SCPI: device-specific

Modes: BTS, MS

When the measurement is started the instrument automatically assumes the SINGLE mode.

An ongoing measurement can be aborted via the command ABORt. Further results of the phase/frequency error measurement can be then queried without restart of the measurement via the FETCh:BURSt-subsystem.

This command is a query only and therefore has no *RST value assigned. It is available only if measurement of the phase/frequency error is selected (see CONFigure:BURSt:PFERror).

READ:BURSt:PERRor:PEAK:STATus?

This command starts the measurement of the phase and frequency error of the base station or mobile and reads out the status of the peak measurement of the phase error taken over the selected number of bursts.

0: failed, 1: passed

Example: "READ:BURS:PERR:PEAK:STAT?"

Features: *RST value: --
SCPI: device-specific

Modes: BTS, MS

When the measurement is started the instrument automatically assumes the SINGLE mode.

An ongoing measurement can be aborted via the command ABORt. Further results of the phase/frequency error measurement can be then queried without restart of the measurement via the FETCh:BURSt-subsystem.

This command is a query only and therefore has no *RST value assigned. It is available only if measurement of the phase/frequency error is selected (see CONFigure:BURSt:PFERror).

READ:BURSt:PERRor:PEAK:AVERage?

This command starts the measurement of the phase and frequency error of the base station or mobile and reads out the maximum of the peak measurement of the phase error taken over the selected number of bursts.

Example: "READ:BURS:PERR:PEAK:AVER?"

Features: *RST value: --
SCPI: device-specific

Modes: BTS, MS

When the measurement is started the instrument automatically assumes the SINGLE mode.

An ongoing measurement can be aborted via the command ABORt. Further results of the phase/frequency error measurement can be then queried without restart of the measurement via the FETCh:BURSt-subsystem.

This command is a query only and therefore has no *RST value assigned. It is available only if measurement of the phase/frequency error is selected (see CONFigure:BURSt:PFERror).

READ:BURSt:PERRor:PEAK:MAXimum?

This command starts the measurement of the phase and frequency error of the base station or mobile and reads out the maximum of the peak measurement of the phase error for the selected number of bursts.

Example: "READ:BURS:PERR:PEAK:MAX?"

Features: *RST value: --
SCPI: device-specific

Modes: BTS, MS

When the measurement is started the instrument automatically assumes the SINGLE mode.

An ongoing measurement can be aborted via the command ABORt. Further results of the phase/frequency error measurement can be then queried without restart of the measurement via the FETCh:BURSt-subsystem.

This command is a query only and therefore has no *RST value assigned. It is available only if measurement of the phase/frequency error is selected (see CONFigure:BURSt:PFERror).

READ:BURSt:FERRor:STATus?

This command starts the measurement of the phase and frequency error of the base station or mobile and reads out the status of the frequency error taken over the selected number of bursts.

0: failed, 1: passed

Example: "READ:BURS:FERR:STAT?"

Features: *RST value: --
SCPI: device-specific

Modes: BTS, MS

When the measurement is started the instrument automatically assumes the SINGLE mode.

An ongoing measurement can be aborted via the command ABORt. Further results of the phase/frequency error measurement can be then queried without restart of the measurement via the FETCh:BURSt-subsystem.

This command is a query only and therefore has no *RST value assigned. It is available only if measurement of the phase/frequency error is selected (see CONFigure:BURSt:PFERror).

READ:BURSt:FERRor:AVERage?

This command starts the measurement of the phase and frequency error of the base station or mobile and reads out the average of the frequency error taken over the selected number of bursts.

Example: "READ:BURS:FERR:AVER?"

Features: *RST value: --
SCPI: device-specific

Modes: BTS, MS

When the measurement is started the instrument automatically assumes the SINGLE mode.

An ongoing measurement can be aborted via the command ABORt. Further results of the phase/frequency error measurement can be then queried without restart of the measurement via the FETCh:BURSt-subsystem.

This command is a query only and therefore has no *RST value assigned. It is available only if measurement of the phase/frequency error is selected (see CONFigure:BURSt:PFERror).

READ:BURSt:FERRor:MAXimum?

This command starts the measurement of the phase and frequency error of the base station or mobile and reads out the maximum of the frequency error for the selected number of bursts.

Example: "READ:BURS:FERR:MAX?"

Features: *RST value: --
SCPI: device-specific

Modes: BTS, MS

When the measurement is started the instrument automatically assumes the SINGLE mode.

An ongoing measurement can be aborted via the command ABORt. Further results of the phase/frequency error measurement can be then queried without restart of the measurement via the FETCh:BURSt-subsystem.

This command is a query only and therefore has no *RST value assigned. It is available only if measurement of the phase/frequency error is selected (see CONFigure:BURSt:PFERror).

READ:BURSt:POWer?

This command starts the measurement of the maximum output power of the base station or mobile and reads out the result.

Measurement of the maximum output power marks the beginning of a measurement cycle where subsequently the limits of the static and dynamic power control levels are checked step by step (`READ:BURSt:STATic?` or `READ:BURSt:DYNamic?`).

Parameter: The result is read out as an ASCII string in the following format:

<Static Power Ctrl>,<Dyn Power Ctrl>,<Rat-Level>,<Act-Level>, <Delta>,<Status>

<Static Power Ctrl>: 0
<Dyn Power Ctrl>: 0
<Rat-Level>: rated value for the current power control level acc. to standard in dBm
<Act-Level>: measured power in dBm
<Delta>: 0
<Status>: result of limit check in character data form:
PASSED no limits exceeded
FAILED limit exceeded

Example: `"READ:BURS:POW?"`
Result: `0,0,43,44.1,0,PASSED`

Features: *RST value: --
SCPI: device-specific

Modes: BTS, MS

When the measurement is started any ongoing measurement cycle is aborted.

An ongoing measurement can be aborted with the command `ABORT`. This command is a query only and has therefore no *RST value assigned. It is available only when measurement of the maximum carrier power is selected (see `CONFigure:BURSt:POWer`).

READ:BURSt:POWer:STATic?

This command increases the static power control level for the measurement by one step, measures the output power of the base station and reads out the result.

If the command `READ:BURSt:POWer:STATic?` is repeated after the maximum static power control level is reached, the measurement sequence is terminated and the result of the maximum static power control level is read out again. In this case the value 'FINISHED' indicating the status is read out. Before the status value 'FINISHED' is read out, the value 'RUNNING' is output if the total result of the limit check is queried via `CALCulate<1|2>:LIMit<1 to 8>:BURSt:POWer?`.

Parameter: The result is read out as an ASCII string in the following format:

<Static Power Ctrl>,<Dyn Power Ctrl>,<Rat-Level>,<Act-Level>, <Delta>,<Status>

<Static Power Ctrl>: current static power control level
<Dyn Power Ctrl>: current dynamic power control level
<Rat-Level>: rated value for the current power control level acc. to standard in dBm
<Act-Level>: measured power in dBm
<Delta>: difference between the measured power and the power at the previous static power control level.
<Status>: result of the limit check in character data form:
PASSED no limit exceeded
FAILED limit exceeded
FINISHED measurement sequence terminated

Example: `"READ:BURS:POW:STAT?"`
Result: `1,0,41,42.5,1.6,PASSED`

Features: *RST value: --
SCPI: device-specific

Mode: BTS

The command `ABORt` terminates an ongoing measurement and resets the static and dynamic power control level to 0.

This command is only a query and therefore has no *RST value assigned. It is available only if measurement of the maximum carrier power is selected. (see `CONFigure:BURSt:POWer`).

READ:BURSt:POWer:DYNamic?

This command increases the dynamic power control level for the measurement by one step, measures the output power of the base station and reads out the result.

Once the maximum dynamic power control level is reached the command is accepted only after the static power control level is increased by one step.

Note that the command is no longer accepted after the measurement sequence is terminated which implies that the static power control level was read out again with `READ:BURSt:POWer:STATic?` after the maximum value was reached and marked with the 'FINISHED' status.

Parameter: The result is read out as an ASCII string in the following format:

<Static Power Ctrl>,<Dyn Power Ctrl>,<Rat-Level>,<Act-Level>, <Delta>,<Status>

<Static Power Ctrl>: current static power control level
<Dyn Power Ctrl>: current dynamic power control level
<Rat-Level>: rated value for the current power control level acc. to standard in dBm
<Act-Level>: measured power in dBm
<Delta>: difference between the measured power and the power at the previous dynamic power control level.
<Status>: result of the limit check in character data form:
PASSED no limit exceeded
FAILED limit exceeded

Example: `"READ:BURS:POW:DYN?"`
Result: `1,3,35,32.5,5.6,FAILED`

Features: *RST value: --
SCPI: device-specific

Mode: BTS

The command `ABORt` terminates an ongoing measurement and resets the static and dynamic power control level to 0.

This command is only a query and therefore has no *RST value assigned. It is available only if measurement of the maximum carrier power is selected. (see `CONFigure:BURSt:POWer`).

READ:BURSt:POWer:LEVel?

This command increases the power control level for the measurement by one step, measures the output power of the mobile and reads out the result.

Note that the command is no longer accepted after the measurement sequence is terminated which implies that the power control level was read out again with `READ:BURSt:POWer:LEVel?` after the maximum value was reached and marked with the 'FINISHED' status.

Parameter: The result is read out as an ASCII string in the following format:

<0>, <Power Ctrl Level>,<Rat-Level>,<Act-Level>, <Delta>,<Status>

<0>: always 0 (this field is only significant for option FSE-K11)
<Power Ctrl Level>: current power control level
<Rat-Level>: rated value for the current power control level acc. to standard in dBm
<Act-Level>: measured power in dBm
<Delta>: difference between the measured power and the power at the previous power control level.
<Status>: result of the limit check in character data form:
PASSED no limit exceeded
FAILED limit exceeded

Example: "`READ:BURS:POW:LEV?`"
Result: `0,3,35,32.5,5.6,FAILED`

Features: *RST value: --
SCPI: device-specific

Mode: MS

The command `ABORt` terminates an ongoing measurement and resets the power control level to 0.

This command is only a query and therefore has no *RST value assigned. It is available only if measurement of the maximum carrier power is selected. (see `CONFigure:BURSt:POWer`).

READ:BURSt:REFerence[:IMMediate?]

This command starts the premeasurement and as a result provides the measured level in dBm.

Example: "`READ:BURS:REF?`"

Feature: *RST value: --
SCPI: device-specific

Mode: MS, BTS

This is a query command only and therefore has no *RST value.

4.1.5.2 READ:SPECtrum Subsystem

This subsystem provides the commands for starting measurements in the GSM BTS (option FSE-K11) and GSM MS (option FSE-K10) Analyzer mode, which are used to measure the power of the spectral components due to modulation and switching (modulation spectrum, transient spectrum), and for reading out the results subsequently.

COMMAND	PARAMETERS	UNIT	COMMENT
READ			
:SPECtrum			Option FSE-K11 or FSE-K10
:MODulation			
[:ALL]?	--		query only
:SWITching			
[:ALL]?	--		query only

READ:SPECtrum:MODulation[:ALL]?

This command starts the measurement of the modulation spectrum of the base station or mobile and reads out the result. The measurement is performed in the currently set frequency range.

Parameter: The result is read out as a list of partial ASCII result strings separated by ',' in the following format:

<Index>,<Freq1>,<Freq2>,<Level>,<Limit>, <Abs/Rel>,<Status> [,
<Index>,<Freq1>,<Freq2>,<Level>,<Limit>, <Abs/Rel>,<Status>]...

where the part set in '[...]' characterizes a partial result string which can be repeated n times.

<Index>: 0, if the partial result string characterizes a measurement range.
current number <>0, if the partial result string characterizes a single limit excess.

<Freq1>: Start frequency of the measurement range or frequency where the limit is exceeded.

<Freq2>: Stop frequency of the measurement range or frequency where the measured range is exceeded. The value of <Freq2> is equal to the value of <Freq1>, if either the measurement is performed in the time domain or the partial result string contains a limit excess.

<Level>: Measured maximum level of the partial range or measured level at the test point.

<Limit>: Limit in the partial range or at the test point.

<Abs/Rel>: ABS <Level> and <Limit> are in absolute units (dBm)
REL <Level> and <Limit> are in relative units (dBm)

<Status>: Result of the limit check in character data form:
PASSED no limit exceeded
FAILED limit exceeded
MARGIN margin exceeded
EXC limited excess characterized as an exception

The frequencies <Freq1> and <Freq2> are always absolute and not referred to the carrier frequency.

Example: "READ:SPEC:MOD?"
Result: 0,890E6,915E6,-87.4,-108.0,ABS,FAILED,
1,893.2E6,893.2E6,-83.2,-108.0,ABS,FAILED,
2,895.7E6,895.7E6,-87.4,-108.0,ABS,FAILED

Features: *RST value: --
SCPI: device-specific

Modes: BTS, MS

The command ABORt aborts an ongoing measurement. This command is only a query and therefore has no *RST value assigned. It is available only if measurement of the modulation spectrum is selected. (see CONFigure:SPECtrum:MODulation).

READ:SPECtrum:SWITching[:ALL]?

This command starts the measurement of the transient spectrum of the base station or mobile and reads out the result.

Parameter: The result is read out as a list of partial ASCII result strings separated by ',' in the format used for `READ:SPECtrum:MODulation[:ALL]?`.

Example: "`READ:SPEC:SWIT?`"

Result:
```
0,833.4E6,833.4E6,37.4,-36.0,ABS,MARGIN,
1,834.0E6,834.0E6,-35.2,-36.0,ABS,FAILED,
2,834.6E6,834.6E6,-74.3,-75.0,REL,FAILED
0,835.0E6,835.0E6,-65,0,-60.0,REL,PASSED
```

Features: *RST value: --
SCPI: device-specific

Modes: BTS, MS

The command `ABORt` aborts an ongoing measurement.

This command is only a query and therefore has no *RST value assigned. It is available only if measurement of the transient spectrum is selected. (see `CONFigure:SPECtrum:SWITCHing`).

4.1.5.3 READ:SPURious Subsystem

This subsystem provides the commands for starting measurements in the GSM BTS (option FSE-K11) and GSM MS (option FSE-K10) Analyzer mode, which are used to measure the power of spurious emissions, and for reading out the results subsequently.

COMMAND	PARAMETERS	UNIT	COMMENT
READ			
:SPURious			Option FSE-K11 or FSE-K10
[:ALL]?			query only
:STEP?			query only

READ:SPURious[:ALL]?

This command starts the measurement of the spurious emissions of the base station or mobile and reads out the result. The measurement is performed in the currently set frequency range.

Parameter: The result is read out as a list of partial ASCII result strings separated by ',' in the following format:

<Index>,<Freq1>,<Freq2>,<Level>,<Limit>, <Abs/Rel>,<Status> [,
<Index>,<Freq1>,<Freq2>,<Level>,<Limit>, <Abs/Rel>,<Status>]...

where the part set in '[...]' characterizes a partial result string which can be repeated n times.

<Index>: 0, if the partial result string characterizes a measurement range.
current number <>0, if the partial result string characterizes a single limit excess.

<Freq1>: Start frequency of the measurement range or frequency where the limit is exceeded.

<Freq2>: Stop frequency of the measurement range or frequency where the measured range is exceeded. The value of <Freq2> is equal to the value of <Freq1>, if either the measurement is performed in the time domain or the partial result string contains a limit excess.

<Level>: Measured maximum level of the partial range or measured level at the test point.

<Limit>: Limit in the partial range or at the test point.

<Abs/Rel>: ABS <Level> and <Limit> are in absolute units (dBm)
REL <Level> and <Limit> are in absolute units (dBm)

<Status>: Result of the limit check in character data form:
PASSED no limit exceeded
FAILED limit exceeded
MARGIN margin exceeded

Example: "READ:SPUR?"
Result: 0,890E6,915E6,-87.4,-108.0,ABS,FAILED,
1,893.2E6,893.2E6,-83.2,-108.0,ABS,FAILED,
2,895.7E6,895.7E6,-87.4,-108.0,ABS,FAILED

Features: *RST value: --
SCPI: device-specific

Modes: BTS, MS

The command ABORt aborts an ongoing measurement. This command is only a query and therefore has no *RST value assigned. It is available only if measurement of the spurious emissions is selected. (see CONFigure:SPURious).

READ:SPURious:STEP?

This command starts the next single step for measuring the spurious emissions in the STEP mode and reads out the results. The measurement is performed in the currently set frequency range.

If the command `READ:SPURious:STEP?` is sent again after the last single step is reached, the measurement sequence is terminated, the result of the last single step is output again and characterized by the value 'FINISHED' indicating its status. Until the status value 'FINISHED' is returned, the value 'RUNNING' is output when the total result of the limit check is queried with the command `CALCulate<1|2>:LIMit<1 to 8>:SPURious?`.

Afterwards, sending the command again causes a restart of the measurement.

Parameter: The measured result is read out as a list of partial result strings separated by ',' and in the same format as for the command `READ:SPURious[:ALL]?`.
The additional status value 'FINISHED' marks the end of a measurement sequence.

Example: "`READ:SPUR:STEP?`"
Result: First query: 0,890E6,915E6,-87.4,-108.0,ABS,FAILED
...
Second-last query:1,893.2E6,893.2E6,-83.2,-108.0,ABS,FAILED
Last query: 1,893.2E6,893.2E6,-83.2,-108.0,ABS,FINISHED

Features: *RST value: --
SCPI: device-specific

Modes: BTS, MS

The command `ABORt` aborts an ongoing measurement. If the command `READ:SPURious:STEP?` is sent again, the instrument restarts with the first single step.

This command is only a query and therefore has no *RST value assigned. It is available only if measurement of the spurious emissions is selected. (see `CONFigure:SPURious`).

4.1.6 SENSe Subsystem

The SENSe subsystem is itself divided up into several subsystems. The commands of these subsystems directly control device-specific settings, they do not refer to the signal characteristics of the measurement signal.
The SENSe subsystem controls the essential parameters of the analyzer and vector analyzer. In accordance with the SCPI standard, it is for this reason optional, which means that it is not necessary to include the SENSe node in command sequences.

In the split-screen representation, a distinction is made between SENSe1 and SENSe2:

SENSe1 ≙ screen A;

SENSe2 ≙ screen B

4.1.6.1 SENSe:BANDwidth Subsystem

This subsystem controls the setting of the instrument's filter bandwidths. Both groups of commands (BANDwidth and BWIDth) perform the same functions.

COMMAND	PARAMETERS	UNIT	COMMENT
[SENSe<1|2>] :BANDwidth | :BWIDth [:RESolution]	<numeric_value>	HZ	

[SENSe<1|2>:]BANDwidth|BWIDth[:RESolution] <numeric_value>

This command defines the analyzer's resolution bandwidth.

Example: "BAND 1MHz"

Features: *RST value: - (AUTO is set to ON)
SCPI: conforming

Modes: A, VA, BTS, MS

The values for the resolution bandwidth are rounded in 1 | 2 | 3 | 5 steps.

In the GSM BTS/MS ANALYZER mode with option FSE-K11/K10, the command is available for POWER vs. TIME measurement. In this case, the parameters DEFault (bandwidth setting according to GSM standard), 300KHZ and 1MHZ are permitted.

4.1.6.2 SENSe:CORRection-Subsystem

The SENSe:CORRection-subsystem informs the instrument about external attenuation and preamplification.

COMMAND	PARAMETERS	UNIT	COMMENT
[SENSe<1|2>]			
:CORRection			
:LOSS			option FSE-K11 or FSE-K10
:INPut			
[:MAGNitude]	<numeric_value>	DB	
:RXGain			option FSE-K11 or FSE-K10
:INPut			
[:MAGNitude]	<numeric_value>	DB	

[SENSe<1|2>:]CORRection:LOSS:INPut[:MAGNitude] <numeric_value>

This command announces to the instrument a possibly needed external attenuation of the input signal, so that it is taken into account later when the level is set.

Parameter: <numeric_value>::= value of external attenuation in dB.

Example: "CORR:LOSS:INP 30DB "

Features: *RST value: 20dB
SCPI: device-specific

Modes: BTS, MS

The external attenuation must be selected such that the input power of the analyzer does not exceed 27 dBm.

[SENSe<1|2>:]CORRection:RXGain:INPut[:MAGNitude] <numeric_value>

This command announces to the instrument a possibly needed preamplification in the RX-band (RX BAND GAIN), so that it is taken into account later when the measured values are read out.

Parameter: <numeric_value>::= value of the amplification in dB.

Example: "CORR:RXG:INP 30DB "

Features: *RST value: 0 dB
SCPI: device-specific

Modes: BTS, MS

4.1.7 TRIGger Subsystem

The TRIGger subsystem is used to synchronize instrument actions with events. This makes it possible to control and synchronize the start of a sweep. An external trigger signal can be fed to the connector at the rear panel of the instrument. In split screen mode, a distinction is made between TRIGger1 (screen A) and TRIGger2 (screen B).

COMMAND	PARAMETERS	UNIT	COMMENT
TRIGger<1|2>			
[:SEQuence]			
:SYNChronize			
:ADJust		s	
:FRAMe	<numeric_value>		Option FSE-K11
:AUTO	ONCE		Option FSE-K11 & FSE-B7
		s	Option FSE-K11
:SLOT	<numeric_value>		Option FSE-K11 & FSE-B7
:AUTO	ONCE		Option FSE-K11or FSE-K10 & FSE-B7
:SOURCe	FRAMe | TSC		

TRIGger[:SEQuence]:SYNChronize:ADJust:FRAMe 0 to 100s

This command defines the correction value for the time offset between the frame trigger and the midamble of the slot selected. The value set is corrected by means of the calculated offsets of the other slots and used as a base value for the correction of all slots.
This correction value is necessary in order to conserve the exact time relation between the trigger event and the midamble of the slot in question in cases where there is no midamble triggering.

Example: `"TRIG:SYNC:ADJ:FRAM 30us"`

Features: *RST value: -- (depending on the slot selected)
SCPI: device-specific

Modes: BTS

TRIGger[:SEQuence]:SYNChronize:ADJust:FRAMe:AUTO ONCE

This command determines once the correction value for the time offset between the frame trigger and the midamble of the slot selected. The value set is corrected by means of the calculated offsets of the other slots and used as a base value for the correction of all slots.
This correction value is necessary in order to conserve the exact time relation between the trigger event and the midamble of the slot in question in cases where there is no midamble triggering.

Example: `"TRIG:SYNC:ADJ:FRAM:AUTO ONCE"`

Features: *RST value: --
SCPI: device-specific

Modes: BTS

This command is available only in conjunction with option GSM BTS Analyzer, FSE-K11, and with option Vector Signal Analysis, FSE-B7.

TRIGger[:SEQuence]:SYNChronize:ADJust:SLOT 0 to 100s

This command defines the correction value for the time offset between the frame trigger and the midamble of the slot selected, without influencing the correction values of the other slots.
This correction value is necessary in order to conserve the exact time relation between the trigger event and the midamble of the slot in question in cases where there is no midamble triggering. The value set is corrected by means of the calculated offsets of the other slots and used as a base value for the correction of all slots.

Example: `"TRIG:SYNC:ADJ:SLOT 30us"`

Features: *RST value: -- (depending on slot selected)
SCPI: device-specific

Modes: BTS

TRIGger[:SEQuence]:SYNChronize:ADJust:SLOT:AUTO ONCE

This command defines the correction value for the time offset between the frame trigger and the midamble of the slot selected. The value set is corrected by means of the calculated offsets of the other slots and used as a base value for the correction of all slots.
This correction value is necessary in order to conserve the exact time relation between the trigger event and the midamble of the slot in question in cases where there is no midamble triggering.

Example: `"TRIG:SYNC:ADJ:SLOT:AUTO ONCE"`

Features: *RST value: --
SCPI: device-specific

Modes: BTS

This command is available only in conjunction with option GSM BTS Analyzer, FSE-K11, and with option Vector Signal Analysis, FSE-B7.

TRIGger[:SEQuence]:SYNChronize:SOURce FRAME | TSC

This command defines the trigger reference point for measurements in the time domain (carrier power, power vs. time). The frame trigger of the base station or mobile may be selected as well as the relation to the midamble (TSC) of the slot to be measured.

Example: `"TRIG:SYNC:SOUR TSC"`

Features: *RST value: FRAME
SCPI: device-specific

Modes: BTS, MS

This command is available only in conjunction with option GSM BTS Analyzer, FSE-K11, or GSM MS Analyzer, FSE-K10. The parameter TSC requires in addition the option Vector Signal Analysis, FSE-B7.

4.2 Table of Softkeys with IEC/IEEE-Bus Command Assignment

4.2.1 GSM BTS Analysis Mode (Option FSE-K11)

4.2.1.1 CONFIGURATION Key Group

MODE	
GSM BTS ANALYZER	INSTrument<1|2>[:SELect] BGSM
SETTINGS	--
EXTERNAL ATTEN	[SENSe<1|2>:]CORRection:LOSS:INPut[:MAGNitude] <numeric_value>
ARFCN / FREQUENCY	--
ARFCN	CONFigure:BTS:ARFCn <numeric_value>
ARFCN AUTOSELECT	CONFigure:BTS:ARFCn:AUTO ONCE
FREQUENCY	SENSe<1|2>:FREQuency:CENTer <numeric_value>
POWER SETTINGS	--
EXTERNAL ATTEN	[SENSe<1|2>:]CORRection:LOSS:INPut[:MAGNitude] <numeric_value>
NOMINAL OUTPUTPWR	CONFigure:BTS:POWer:EXPected <numeric_value>
POWER CLASS	CONFigure:BTS:POWer:CLASs <numeric_value> | M1 | M2 | M3
STATIC PWR CTRL LEVEL	CONFigure:BTS:POWer:STATic <numeric_value>
DYNAM PWR CTRL LEVEL	CONFigure:BTS:POWer:DYNamic <numeric_value>
LIMIT/PWR COUPLED	CONFigure:BTS:POWer:COUPled ON|OFF
SIGNAL POWER	CONFigure:BTS:POWer:EXPected <numeric_value>
LIMIT LINE REF POWER	CONFigure:BTS:POWer:LLINe <numeric_value>
LIMIT MARGIN	CALCulate<1|2>:LIMit<1...8>:MARGin <numeric_value>
SLOT NO.	--
SLOT NO.	CONFigure:BTS:CHANnel:SLOT 0...7

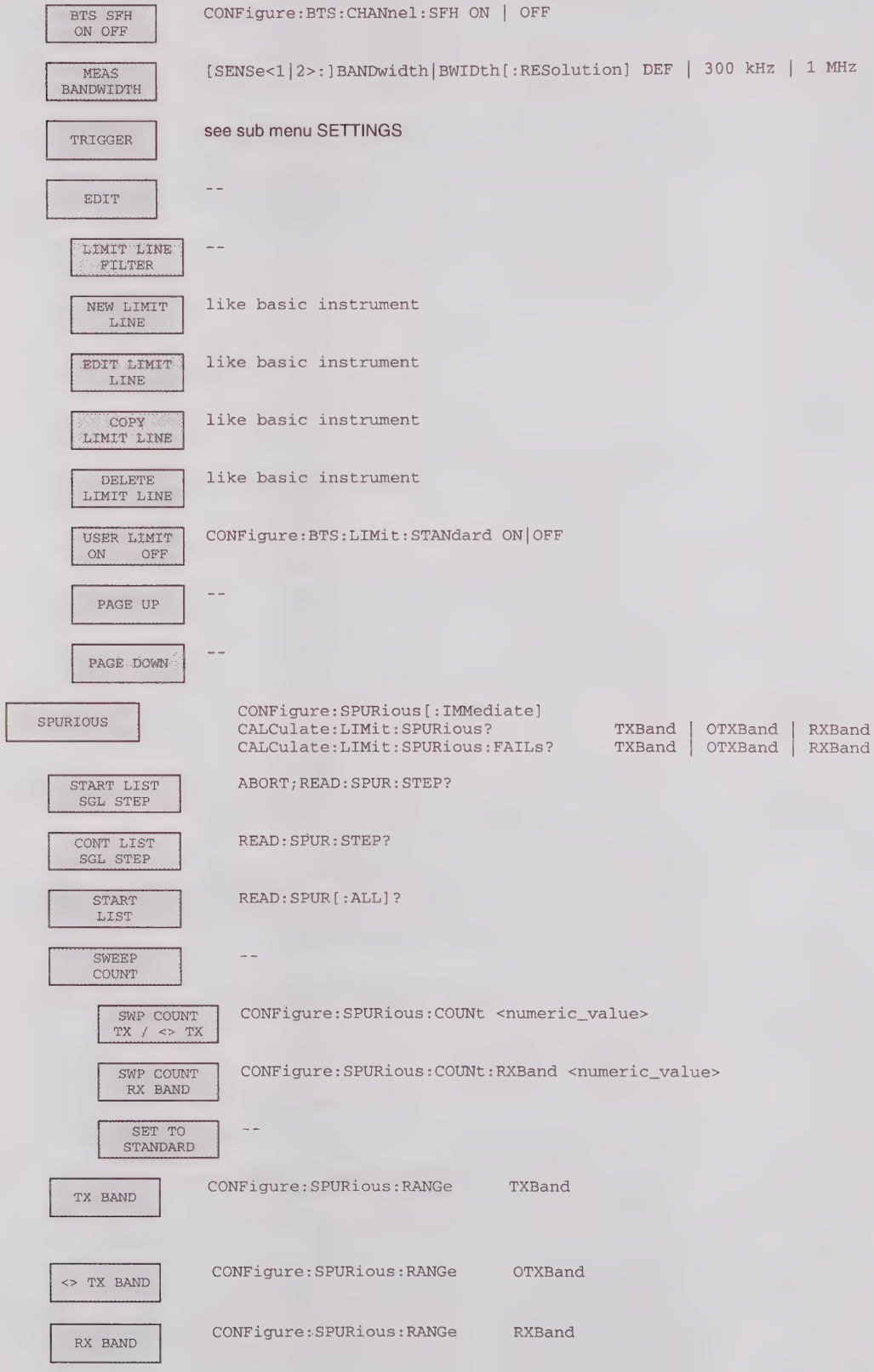
SLOT NO. AUTOSELECT	CONFigure:BTS:CHANnel:SLOT:AUTO ONCE
MIDAMBLE	CONFigure:BTS:CHANnel:TSC 0...7 CONFigure:BTS:CHANnel:TSC:AUTO ON | OFF
TRIGGER	--
FREE RUN	TRIGger<1|2>[:SEQuence]:SOURce IMMediate
EXTERN	TRIGger<1|2>[:SEQuence]:SOURce EXTernal TRIGger<1|2>[:SEQuence]:LEVel[:EXTernal] -5.0...+5.0V
SLOPE POS NEG	TRIGger<1|2>[:SEQuence]:SLOPe POSitive|NEGative
TRIGGER ADJUST	--
FRAME COARSE	TRIGger<1|2>[:SEQuence]:SYNChronize:ADJust:FRAMe <numeric_value>
FRAME FINE	TRIGger<1|2>[:SEQuence]:SYNChronize:ADJust:FRAMe <numeric_value>
AUTO FRAME ADJUST	TRIGger<1|2>[:SEQuence]:SYNChronize:ADJust:FRAMe:AUTO ONCE
SLOT ADJUST	TRIGger<1|2>[:SEQuence]:SYNChronize:ADJust:SLOT <numeric_value>
AUTO SLOT ADJUST	TRIGger<1|2>[:SEQuence]:SYNChronize:ADJust:SLOT:AUTO ONCE
TRIGGER LEVEL	TRIGger<1|2>[:SEQuence]:LEVel[:EXTernal] <numeric_value>
SLOPE POS NEG	TRIGger<1|2>[:SEQuence]:SLOPe POSitive|NEGative
DEFAULT SETTINGS	CONFigure:BTS:PRESet
P-GSM 900	CONFigure:BTS:NETWork[:TYPE] PGSM | PGSM900
E-GSM 900	CONFigure:BTS:NETWork[:TYPE] EGSM | EGSM900
GSM 1800 (DCS 1800)	CONFigure:BTS:NETWork[:TYPE] DCS | GSM1800
GSM 1900 (PCS 1900)	CONFigure:BTS:NETWork[:TYPE] PCS | GSM1900
R-GSM 900	CONFigure:BTS:NETWork[:TYPE] RGSM | RGSM900
PHASE I	CONFigure:BTS:NETWork:PHASe 1
PHASE II	CONFigure:BTS:NETWork:PHASe 2
PHASE II+	CONFigure:BTS:NETWork:PHASe 2,PLUS

PHASE/FREQ ERROR	CONFigure:BURSt:PFERror[:IMMediate]
SINGLE	INITiate<1|2>:CONTinuous OFF; INITiate<1|2>[:IMMediate]
CONTINUOUS	INITiate<1|2>:CONTinuous ON; INITiate<1|2>[:IMMediate]
NO. OF BURSTS	--
SET MANUAL	CONFigure:BURSt:PFERror:COUNt <numeric_value>
SET TO STANDARD	--
ARFCN / FREQUENCY	see sub menu SETTINGS
POWER SETTINGS	see sub menu SETTINGS
X UNIT SYMB TIME	CALCulate<1|2>:X:UNIT:TIME S|SYM
TRIGGER	see sub menu SETTINGS
EDIT	--
PHASE PEAK	CONFigure:BTS:LIMit PPEak
PHASE RMS	CONFigure:BTS:LIMit PRMS
FREQUENCY	CONFigure:BTS:LIMit FREQuency
USER LIMIT ON OFF	CONFigure:BTS:LIMit:STANdard ON|OFF
CARRIER POWER	CONFigure:BURSt:POWer[:IMMediate] CALCulate:LIMit:BURSt:POWer?
MEAS MAX OUTPUT PWR	READ:BURSt:POWer?
INC STATIC PWR CTRL	READ:BURSt:POWer:STATic?
INC DYNAM PWR CTRL	READ:BURSt:POWer:DYNamic?
NO. OF BURSTS	--
SET MANUAL	CONFigure:BURSt:POWer:COUNt <numeric_value>
SET TO STANDARD	--
SGL MEAS ON OFF	CONFigure:BTS:POWer:SINGle[:STATe] ON|OFF
MEAS SGL PWR LEVEL	READ:BURSt:POWer?

STATIC PWR CTRL LEVEL	CONFigure:BTS:POWer:STATic <numeric_value>
DYNAM PWR CTRL LEVEL	CONFigure:BTS:POWer:DYNamic <numeric_value>
CLEAR SGL RESULT TAB	CONFigure:BTS:POWer:SINGle:CLEar
SIGNAL POWER	CONFigure:BTS:POWer:EXPected <numeric_value>
ARFCN / FREQUENCY	see sub menu SETTINGS
POWER SETTINGS	see sub menu SETTINGS
CONDITIONS NORM EXTR	CONFigure:BURSt:POWer:CONDition NORMal | EXTReme
MEAS BANDWIDTH	[SENSe<1|2>:]BANDwidth|BWIDth[:RESolution] DEF | 300 kHz | 1 MHz
SYNC TO MIDAMBLE	TRIGger<1|2>[:SEQuence]:SYNChronize:SOURce FRAMe | TSC
TRIGGER	see sub menu SETTINGS
POWER VS TIME	CONFigure:BURSt:PTEMplate[:IMMediate] CALCulate:LIMit:BURSt:PTEMplate?
SINGLE	INITiate<1|2>:CONTinuous OFF; INITiate[:IMMediate]
CONTINUOUS	INITiate<1|2>:CONTinuous ON; INITiate[:IMMediate]
BURST HIGH RESOLUTION	CONFigure:BURSt:PTEMplate:SELect TOP
NO. OF BURSTS	--
SET MANUAL	CONFigure:BURSt:PTEMplate:COUNt <numeric_value>
SET TO STANDARD	--
FULL BURST	CONFigure:BURSt:PTEMplate:SELect FULL
RISING EDGE	CONFigure:BURSt:PTEMplate:SELect RISing
FALLING EDGE	CONFigure:BURSt:PTEMplate:SELect FALLing
START REF MEAS	READ:BURSt:REFerence[:IMMediate]?
REF MEAS AUTO USER	CONFigure:BURSt:REFerence:AUTO ON|OFF
ARFCN / FREQUENCY	see sub menu SETTINGS
POWER SETTINGS	see sub menu SETTINGS

X UNIT SYMB TIME	CALCulate<1|2>:X:UNIT:TIME S|SYM
MEAS BANDWIDTH	[SENSe<1|2>:]BANDwidth|BWIDth[:RESolution] DEF | 300 kHz | 1 MHz
SYNC TO MIDAMBLE	TRIGger<1|2>[:SEQuence]:SYNChronize:SOURce FRAMe | TSC
TRIGGER	see sub menu SETTINGS
EDIT	--
LIMIT LINE FILTER	--
NEW LIMIT LINE	like basic instrument
EDIT LIMIT LINE	like basic instrument
COPY LIMIT LINE	like basic instrument
DELETE LIMIT LINE	like basic instrument
USER LIMIT ON OFF	CONFigure:BTS:LIMit:STANdard ON|OFF
PAGE UP	--
PAGE DOWN	--
MODULATION SPECTRUM	CONFigure:SPECtrum:MODulation[:IMMediate] CALCulate:LIMit:SPECtrum:MODulation? ARFCn|TXBand|RXBand|COMBined CALCulate:LIMit:SPECtrum:MODulation:FAILs? ARFCn|TXBand|RXBand|COMBined CALCulate:LIMit:SPECtrum:MODulation:EXCeptions? ARFCn|TXBand|RXBand|COMBined
SINGLE FREQ SWEEP	INITiate<1|2>:CONTinuous OFF; INITiate[:IMMediate]
CONTINUOUS FREQ SWEEP	INITiate<1|2>:CONTinuous ON; INITiate[:IMMediate]
START LIST	READ:SPECtrum:MODulation[:ALL]?
NO. OF BURSTS	--
SET MANUAL	CONFigure:SPECtrum:MODulation:COUNt <numeric_value>
SET TO STANDARD	--
ARFCN ±1.8 MHZ	CONFigure:SPECtrum:MODulation:RANGe ARFCn
TX BAND	CONFigure:SPECtrum:MODulation:RANGe TXBand
±1.8 MHZ / TX BAND	CONFigure:SPECtrum:MODulation:RANGe COMBined

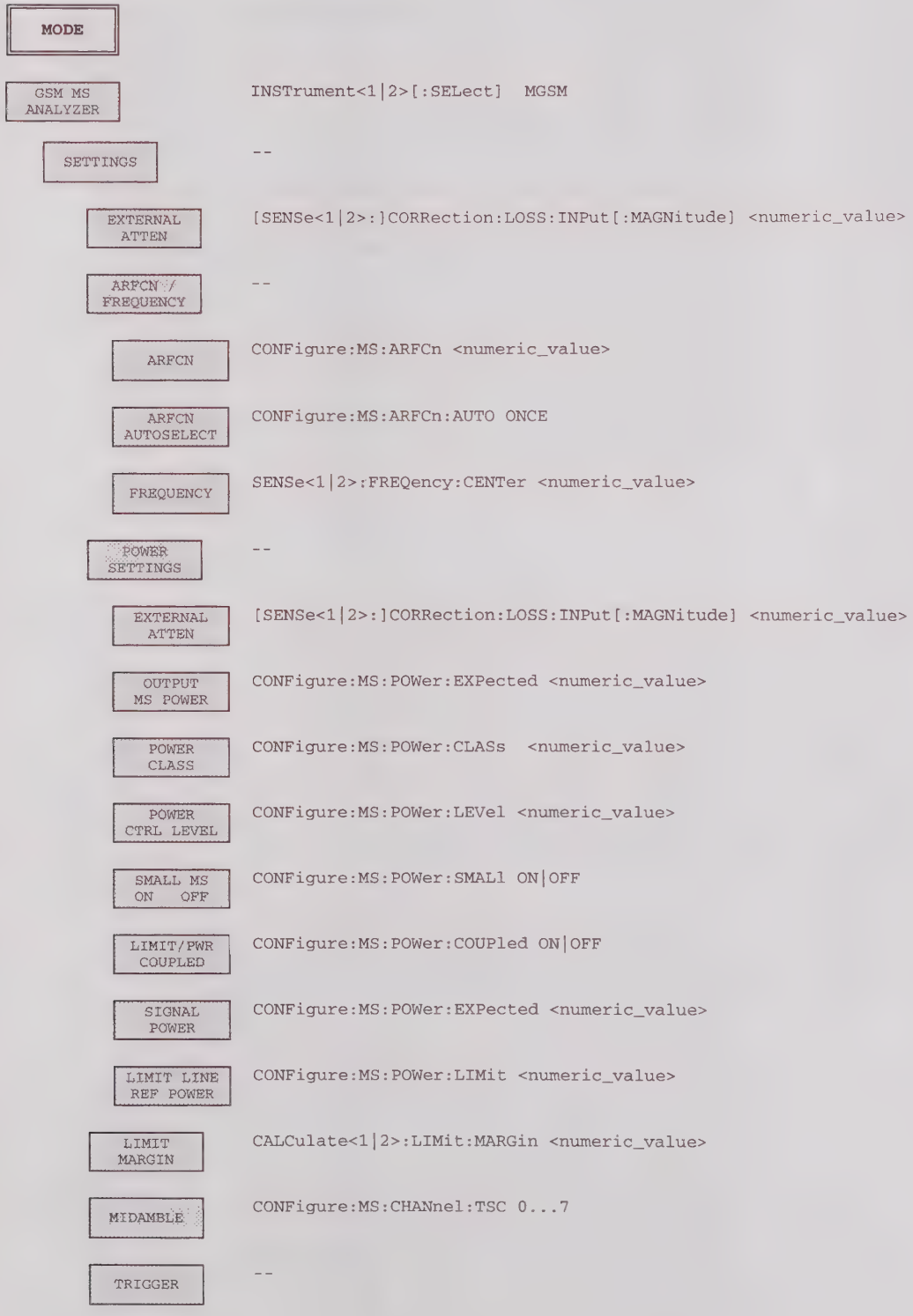
RX BAND	CONFigure:SPECtrum:MODulation:RANGe RXBand
ARFCN / FREQUENCY	see sub menu SETTINGS
POWER SETTINGS	see sub menu SETTINGS
RX BAND GAIN	[SENSe<1|2>:]CORRection:RXGain:INPut[:MAGNitude] <numeric_value>
TX GATE ON OFF	CONFigure:SPECtrum:MODulation:TGATe ON | OFF
TRIGGER	see sub menu SETTINGS
EDIT	--
LIMIT LINE FILTER	--
NEW LIMIT LINE	like basic instrument
EDIT LIMIT LINE	like basic instrument
COPY LIMIT LINE	like basic instrument
DELETE LIMIT LINE	like basic instrument
USER LIMIT ON OFF	CONFigure:BTS:LIMit:STANdard ON|OFF
PAGE UP	--
PAGE DOWN	--
TRANSIENT SPECTRUM	CONFigure:SPECtrum:SWITching[:IMMediate] CALCulate:LIMit:SPECtrum:SWITching? ARFCn|TXBand|RXBand|COMBined CALCulate:LIMit:SPECtrum:SWITching:FAILs? ARFCn|TXBand|RXBand|COMBined
SINGLE FREQ SWEEP	INITiate<1|2>:CONTinuous OFF; INITiate[:IMMediate]
CONTINUOUS FREQ SWEEP	INITiate<1|2>:CONTinuous ON; INITiate[:IMMediate]
START LIST	READ:SPECtrum:SWITching[:ALL]?
NO. OF BURSTS	--
SET MANUAL	CONFigure:SPECtrum:SWITching:COUNt <numeric_value>
SET TO STANDARD	--
ARFCN / FREQUENCY	see sub menu SETTINGS
POWER SETTINGS	see sub menu SETTINGS


BTS SFH ON OFF
CONFigure:BTS:CHANnel:SFH ON | OFF
MEAS BANDWIDTH
[SENSe<1|2>:]BANDwidth|BWIDth[:RESolution] DEF | 300 kHz | 1 MHz
TRIGGER
see sub menu SETTINGS
EDIT
--
LIMIT LINE FILTER
--
NEW LIMIT LINE
like basic instrument
EDIT LIMIT LINE
like basic instrument
COPY LIMIT LINE
like basic instrument
DELETE LIMIT LINE
like basic instrument
USER LIMIT ON OFF
CONFigure:BTS:LIMit:STANdard ON|OFF
PAGE UP
--
PAGE DOWN
--
SPURIOUS
CONFigure:SPURious[:IMMediate]
CALCulate:LIMit:SPURious? TXBand | OTXBand | RXBand
CALCulate:LIMit:SPURious:FAILs? TXBand | OTXBand | RXBand
START LIST SGL STEP
ABORT;READ:SPUR:STEP?
CONT LIST SGL STEP
READ:SPUR:STEP?
START LIST
READ:SPUR[:ALL]?
SWEEP COUNT
--
SWP COUNT TX / <> TX
CONFigure:SPURious:COUNt <numeric_value>
SWP COUNT RX BAND
CONFigure:SPURious:COUNt:RXBand <numeric_value>
SET TO STANDARD
--
TX BAND
CONFigure:SPURious:RANGe TXBand
<> TX BAND
CONFigure:SPURious:RANGe OTXBand
RX BAND
CONFigure:SPURious:RANGe RXBand

TX BAND ±2.MHZ	CONFigure:SPURious:RANGe COMBined
SELECT STEP	CONFigure:SPURious:STEP:COUNT? CONFigure:SPURious:STEP<1..26> ON|OFF
ARFCN / FREQUENCY	see sub menu SETTINGS
POWER SETTINGS	see sub menu SETTINGS
BTS SFH ON OFF	CONFigure:BTS:CHANnel:SFH ON | OFF
TX SUPPR ON OFF	CONFigure:BTS:TXSupp ON | OFF
RX BAND GAIN	[SENSe<1|2>:]CORRection:RXGain:INPut[:MAGNitude] <numeric_value>
COSITING	CONFigure:BTS:COSiting ON | OFF
SWEEPTIME STD AUTO	CONFigure:BTS:SWEeptime STANdard|AUTO
TRIGGER	see sub menu SETTINGS
EDIT	--
LIMIT LINE FILTER	--
NEW LIMIT LINE	like basic instrument
EDIT LIMIT LINE	like basic instrument
COPY LIMIT LINE	like basic instrument
DELETE LIMIT LINE	like basic instrument
USER LIMIT ON OFF	CONFigure:BTS:LIMit:STANdard ON|OFF
PAGE UP	--
PAGE DOWN	--

4.2.2 GSM MS Analysis Mode (Option FSE-K10)

4.2.2.1 CONFIGURATION Key Group



FREE RUN	TRIGger<1|2>[:SEQuence]:SOURce IMMediate
VIDEO	TRIGger<1|2>[:SEQuence]:SOURce VIDeo
EXTERN	TRIGger<1|2>[:SEQuence]:SOURce EXTernal TRIGger<1|2>[:SEQuence]:LEVel[:EXTernal] -5.0...+5.0V
RF POWER	TRIGger<1|2>[:SEQuence]:SOURce RFPower
SLOPE POS NEG	TRIGger<1|2>[:SEQuence]:SLOPe POSitive|NEGative
TRIGGER ADJUST	--
COURSE ADJUST	TRIGger<1|2>[:SEQuence]:SYNChronize:ADJust:SLOT <numeric_value>
FINE ADJUST	TRIGger<1|2>[:SEQuence]:SYNChronize:ADJust:SLOT <numeric_value>
AUTO ADJUST	TRIGger<1|2>[:SEQuence]:SYNChronize:ADJust:SLOT:AUTO ONCE
TRIGGER LEVEL	TRIGger<1|2>[:SEQuence]:LEVel[:EXTernal] <numeric_value>
SLOPE POS NEG	TRIGger<1|2>[:SEQuence]:SLOPe POSitive|NEGative
DEFAULT SETTINGS	CONFigure:MS:PRESet
P-GSM 900	CONFigure:MS:NETWork[:TYPE] PGSM | PGSM900
E-GSM 900	CONFigure:MS:NETWork[:TYPE] EGSM | EGSM900
GSM 1800 (DCS 1800)	CONFigure:MS:NETWork[:TYPE] DCS | GSM1800
GSM 1900 (PCS 1900)	CONFigure:MS:NETWork[:TYPE] PCS | GSM1900
R-GSM 900	CONFigure:MS:NETWork[:TYPE] RGSM | RGSM900
PHASE I	CONFigure:MS:NETWork:PHASe 1
PHASE II	CONFigure:MS:NETWork:PHASe 2
PHASE II+	CONFigure:MS:NETWork:PHASe 2,PLUS

PHASE/FREQ ERROR	CONFigure:BURSt:PFERror[:IMMediate]
SINGLE	INITiate<1|2>:CONTinuous OFF; INITiate<1|2>[:IMMediate]
CONTINUOUS	INITiate<1|2>:CONTinuous ON; INITiate<1|2>[:IMMediate]
NO. OF BURSTS	
SET MANUAL	CONFigure:BURSt:PFERror:COUNt <numeric_value>
SET TO STANDARD	--
ARFCN / FREQUENCY	see sub menu SETTINGS
POWER SETTINGS	see sub menu SETTINGS
X UNIT SYMB TIME	CALCulate<1|2>:X:UNIT:TIME S|SYM
TRIGGER	see sub menu SETTINGS
EDIT	--
PHASE PEAK	CONFigure:MS:LIMit:PPEak
PHASE RMS	CONFigure:MS:LIMit:PRMS
FREQUENCY	CONFigure:MS:LIMit:FREQuency
USER LIMIT ON OFF	CONFigure:MS:LIMit:STANdard ON|OFF
CARRIER POWER	CONFigure:BURSt:POWer[:IMMediate] CALCulate:LIMit:BURSt:POWer?
MEAS MAX OUTPUT PWR	READ:BURSt:POWer?
INC PWR CTRL LEVEL	READ:BURSt:POWer:LEVel?
NO. OF BURSTS	--
SET MANUAL	CONFigure:BURSt:POWer:COUNt <numeric_value>
SET TO STANDARD	--
SGL MEAS ON OFF	CONFigure:MS:POWer:SINGle[:STATe] ON|OFF

MEAS SGL PWR LEVEL	READ:BURSt:POWer?
POWER CTRL LEVEL	CONFigure:MS:POWer:LEVel <numeric_value>
CLEAR SGL RESULT TAB	CONFigure:MS:POWer:SINGle:CLEar
SIGNAL POWER	CONFigure:MS:POWer:EXPected <numeric_value>
ARFCN / FREQUENCY	see sub menu SETTINGS
POWER SETTINGS	see sub menu SETTINGS
CONDITIONS NORM EXTR	CONFigure:BURSt:POWer:CONDition NORMal | EXTReme
MEAS BANDWIDTH	[SENSe<1|2>:]BANDwidth|BWIDth[:RESolution] DEF | 300 kHz | 1 MHz
SYNC TO MIDAMBLE	TRIGger<1|2>[:SEQuence]:SYNChronize:SOURce FRAMe | TSC
TRIGGER	see sub menu SETTINGS
POWER VS TIME	CONFigure:BURSt:PTEMplate[:IMMediate] CALCulate:LIMit:BURSt:PTEMplate?
SINGLE	INITiate<1|2>:CONTinuous OFF; INITiate<1|2>[:IMMediate]
CONTINUOUS	INITiate<1|2>:CONTinuous ON; INITiate<1|2>[:IMMediate]
BURST HIGH RESOLUTION	CONFigure:BURSt:PTEMplate:SELect TOP
NO. OF BURSTS	--
SET MANUAL	CONFigure:BURSt:PTEMplate:COUNt <numeric_value>
SET TO STANDARD	--
FULL BURST	CONFigure:BURSt:PTEMplate:SELect FULL
RISING EDGE	CONFigure:BURSt:PTEMplate:SELect RISing
FALLING EDGE	CONFigure:BURSt:PTEMplate:SELect FALLing
START REF MEAS	READ:BURst:REFerence[:IMMediate]?
REF MEAS AUTO USER	CONFigure:BURst:REFerence:AUTO ON|OFF

ARFCN / FREQUENCY	see sub menu SETTINGS
POWER SETTINGS	see sub menu SETTINGS
X UNIT SYMB TIME	CALCulate<1|2>:X:UNIT:TIME S|SYM
MEAS BANDWIDTH	[SENSe<1|2>:]BANDwidth|BWIDth[:RESolution] DEF | 300 kHz | 1 MHz
SYNC TO MIDAMBLE	TRIGger<1|2>[:SEQuence]:SYNChronize:SOURce FRAMe | TSC
TRIGGER	see sub menu SETTINGS
EDIT	--
LIMIT LINE FILTER	--
EDIT LIMIT LINE	like basic instrument
USER LIMIT ON OFF	CONFigure:MS:LIMIt:STANdard ON|OFF
PAGE UP	--
PAGE DOWN	--
MODULATION SPECTRUM	CONFigure:SPECtrum:MODulation[:IMMediate] CALCulate<1|2>:LIMit:SPECtrum:MODulation? ARFCn|TXBand|RXBand|COMBined|DCSRx1800 CALCulate<1|2>:LIMit:SPECtrum:MODulation:FAILs? ARFCn|TXBand|RXBand|COMBined|DCSRx1800 CALCulate<1|2>:LIMit:SPECtrum:MODulation:EXCeptions? ARFCn|TXBand|RXBand|COMBined|DCSRx1800
SINGLE FREQ SWEEP	INITiate<1|2>:CONTinuous OFF; INITiate[:IMMediate]
CONTINUOUS FREQ SWEEP	INITiate<1|2>:CONTinuous ON; INITiate[:IMMediate]
START LIST	READ:SPECtrum:MODulation[:ALL]?
NO. OF BURSTS	--
SET MANUAL	CONFigure:SPECtrum:MODulation:COUNt <numeric_value>
SET TO STANDARD	--
ARFCN ± 1.8 MHz	CONFigure:SPECtrum:MODulation:RANGe ARFCn
TX BAND	CONFigure:SPECtrum:MODulation:RANGe TXBand

±1.8 MHZ TX BAND	CONFigure:SPECtrum:MODulation:RANGe COMBined
RX BAND GSM 900	CONFigure:SPECtrum:MODulation:RANGe RXBand
RX BAND DCS 1800	CONFigure:SPECtrum:MODulation:RANGe DCSRx1800
ARFCN / FREQUENCY	see sub menu SETTINGS
POWER SETTINGS	see sub menu SETTINGS
RX BAND GAIN	[SENSe<1|2>:]CORRection:RXGain:INPut[:MAGNitude] <numeric_value>
TRIGGER	see sub menu SETTINGS
EDIT	--
LIMIT LINE FILTER	--
EDIT LIMIT LINE	like basic instrument
USER LIMIT ON OFF	CONFigure:MS:LIMIt:STANdard ON|OFF
PAGE UP	--
PAGE DOWN	--
TRANSIENT SPECTRUM	CONFigure:SPECtrum:SWITching[:IMMediate] CALCulate<1|2>:LIMit:SPECtrum:SWITching? ARFCn|TXBand|RXBand|COMBined CALCulate<1|2>:LIMit:SPECtrum:SWITching:FAILs? ARFCn|TXBand|RXBand|COMBined
SINGLE FREQ SWEEP	INITiate<1|2>:CONTinuous OFF; INITiate<1|2>[:IMMediate]
CONTINUOUS FREQ SWEEP	INITiate<1|2>:CONTinuous ON; INITiate<1|2>[:IMMediate]
START LIST	READ:SPECtrum:SWITching[:ALL]?
NO. OF BURSTS	--
SET MANUAL	CONFigure:SPECtrum:SWITching:COUNt <numeric_value>
SET TO STANDARD	--
ARFCN / FREQUENCY	see sub menu SETTINGS

POWER SETTINGS	see sub menu SETTINGS
MS SFH ON OFF	CONFigure:MS:CHANnel:SFH ON|OFF
MEAS BANDWIDTH	[SENSe<1|2>:]BANDwidth|BWIDth[:RESolution] DEF | 300 kHz | 1 MHz
TRIGGER	see sub menu SETTINGS
EDIT	--
LIMIT LINE FILTER	--
EDIT LIMIT LINE	like basic instrument
USER LIMIT ON OFF	CONFigure:MS:LIMIt:STANdard ON|OFF
PAGE UP	--
PAGE DOWN	--

SPURIOUS	CONFigure:SPURious[:IMMediate] CALCulate:LIMit:SPURious? CALCulate:LIMit:SPURious:FAILs?	 TXBand | OTXBand | IDLeband TXBand | OTXBand | IDLeband
START LIST SGL STEP	ABORT;READ:SPUR:STEP?	
CONT LIST SGL STEP	READ:SPUR:STEP?	
START LIST	READ:SPUR[:ALL]?	
SWEEP COUNT	--	
SWP COUNT TX / <>TX	CONFigure:SPURious:COUNt <numeric_value>	
TX BAND	CONFigure:SPURious:RANGe	TXBand
<> TX BAND	CONFigure:SPURious:RANGe	OTXBand
IDLE MODE	CONFigure:SPURious:RANGe	IDLeband
TX BAND ±2.0 MHZ	CONFigure:SPURious:RANGe	IDLeband
SELECT STEP	CONFigure:SPURious:STEP:COUNT? CONFigure:SPURious:STEP<1..26> ON|OFF	
ARFCN / FREQUENCY	see sub menu SETTINGS	

POWER SETTINGS	see sub menu SETTINGS
MS SFH ON OFF	CONFigure:MS:CHANnel:SFH ON|OFF
TX SUPPR ON OFF	CONFigure:MS:TXSupp ON | OFF
ANTENNA COND RAD	CONFigure:SPURious:ANTenna CONDucted|RADiated
SWEEPTIME STD AUTO	CONFigure:MS:SWEeptime STANdard|AUTO
TRIGGER	see sub menu SETTINGS
EDIT	--
LIMIT LINE FILTER	--
EDIT LIMIT LINE	like basic instrument
USER LIMIT ON OFF	CONFigure:MS:LIMIt:STANdard ON|OFF
PAGE UP	--
PAGE DOWN	--

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